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EDITORIAL

BROADENING THE FIELD OF INSTITUTE ACTIVITY

It was by no accident that the name Institute was adopted for the organization set up by leading members of the petroleum industry some twenty-seven years ago. They were not seeking to establish a trade association working for purely commercial ends on the one hand or a strictly technical body on the other. Since it was an outgrowth of a committee called together to coordinate the productive power and refining capacity in meeting the country's requirements of oil products in World War I it was natural that similar service in future national emergencies should have held an important place in the minds of the founders and have been named as one of the primary objectives of the newly established body. How well that function has been performed by the members of the Institute and of the oil industry as a whole has been amply demonstrated by the record of the past five years.

Aside from providing a means of cooperation with the government in matters of national concern, however, these pioneers sought to provide the industry with a means of furthering its own progress and usefulness by coordinating the efforts and resources of its own members. They set forth this purpose in the declaration that it should be the aim of the Institute to promote the mutual improvement of its members and the study of the arts and sciences connected with petroleum.

Building on this foundation the Institute has contributed in numberless ways to the advancement of the oil industry's technical knowledge and operating efficiency. One of its important services has been in bringing together in its national and district meetings the results of technical studies, experimentation and research carried on by companies and individuals in all parts of the country and making this information available to all those interested in the subjects discussed. Out of the papers presented at these gatherings and the discussions that have taken place many ideas of great practical value have developed. Through the work of its hundreds of committees, improvements have been brought about in many diverse phases of industry activity ranging from well drilling to bookkeeping and accountancy.

One of the outstanding services of the Institute which has been the means of tremendous savings for operating men and for the manufacturers of equipment as well has been the establishment of uniform standards for drill pipe, casing and other materials used by the industry so that API specifications govern the classification of such equipment all over the world. Standards have been set up for the rating of products which have received universal acceptance. Similarly codes of practice have been recommended for the measuring and testing of oil and its products, for the use of tools, the evaluation of drilling mud weights and many other operations. Fifteen such codes are now in effect.

In collaboration with various scientific and technical societies the Institute has given careful and continuous study to problems which are of common interest. A conspicuous example is afforded by the tests and investigations conducted in cooperation with automotive engineers by which the improvement in motor fuels and in motor performance dependent on fuel quality have gone forward hand in hand.

Mere recapitulation of the topics studied and discussed by committees of the Institute over the years would fill volumes. The fact that under its leadership some two to three thousand members of the industry, including specialists in every phase of its operations, have been directing a good part of their thought and energies to current problems of oil production and utilization and have systematically reported their findings for the benefit of fellow workers has contributed immeasurably to the progress of the industry.

While the consideration of internal problems has been a chief concern of the Institute, and must remain so since progress never ends, the scope and range of its activities have expanded with its growth. It has become steadily more representative of the industry as a whole, inviting to its board the representatives of all sections and branches of the industry to share in its deliberations and decisions. The period from its organization at the end of World War I to the close of World War II may be regarded as constituting one era in its development. Now, at the point of maturity, it is entering a new era of broader activity and greater service in which it will fulfill more completely all the functions of a real Institute, cooperating with all other representative organizations but competing with none, giving consideration to the external as well as the internal problems of the industry, and serving as a medium for the crystallization and expression of industry opinion on broad questions affecting its progress and welfare.

200 COMMITTEES ATTACK

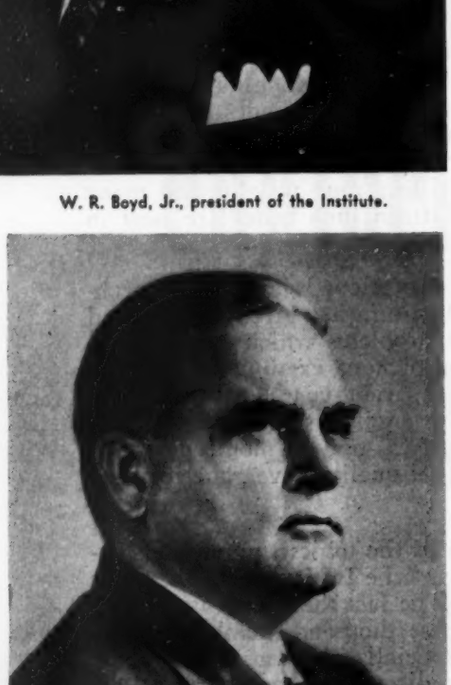
W. R. Boyd, Jr., president of the Institute.

WHEN the American Petroleum Institute was incorporated in March 1919, three principal objectives were named in its by-laws. One of these was "to promote the mutual improvement of its members and the study of the arts and sciences connected with the petroleum industry." The other purposes specifically designated were, first, to afford a means of cooperation with the government in all matters of national concern and, second, to foster foreign and domestic trade in American petroleum products.

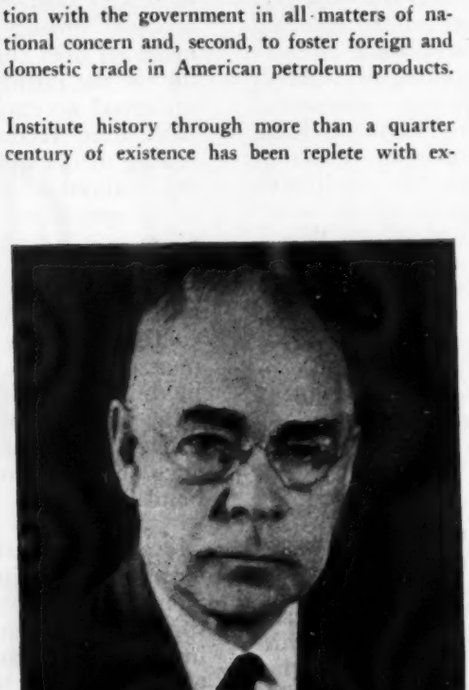
Institute history through more than a quarter century of existence has been replete with examples of effective cooperation with the government whenever the occasion presented itself. When the Federal Oil Conservation Board was created, back in the days of the Coolidge administration, committees of the Institute supplied the Board with a mass of statistical information and collaborated in the consideration of conservation and efficient operation. Out of these activities came a number of constructive measures including a code of marketing practices which received the approval of the Federal Trade Commission and later served as a model for the code adopted by the National Industrial Recovery Administration in the beginning of the New Deal era. During the extended life of the Code Committee and later when the Temporary National Economic Committee conducted its study of American business the work of the Institute assembling and presenting information covering every phase of the oil industry was officially recognized as a public service.

When the nation was forced into World War II American industry a a whole rose to the opportunity for whole hearted, patriotic service. Oil, as is well known, played a highly important part in bringing that struggle to a victorious conclusion. Oil men everywhere contributed to this effort. The Institute, through its broad organization and the prompt action of its officers and members, was able to provide effective leadership in marshalling the full resources of the industry behind the military operations of the United Nations.

During this time all Institute activities except those directly related to the conduct of the war

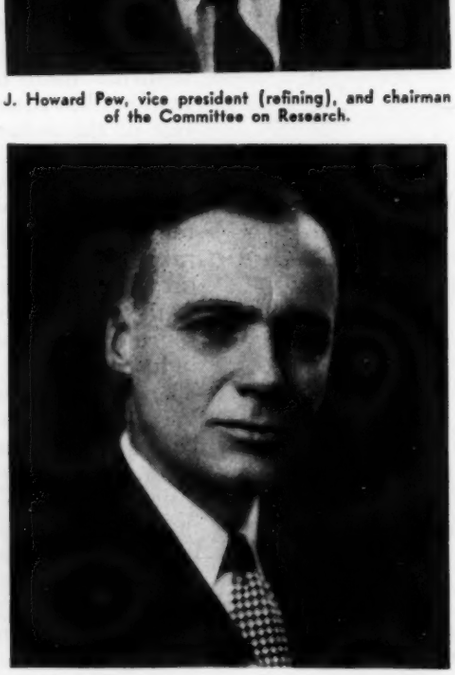


George A. Hill, Jr., vice president (production).

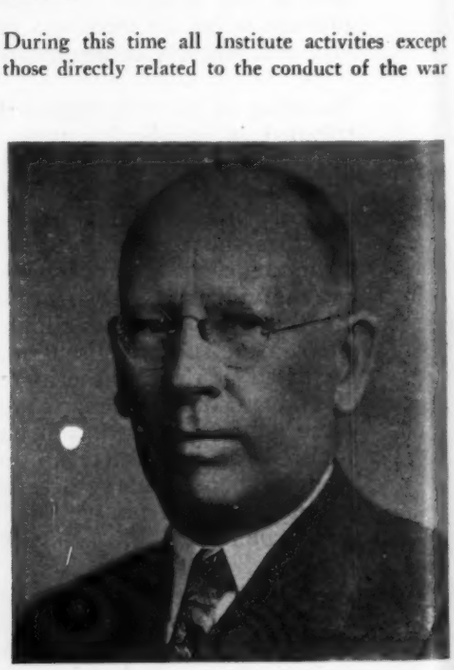


J. Howard Pew, vice president (refining), and chairman of the Committee on Research.

E. V. Weber, vice president (marketing).



B. Brewster Jennings, vice president (transportation).



O. D. Donnell, treasurer and chairman of the Committee on Measuring, Sampling and Testing of Crude.

POSTWAR OIL PROBLEMS

were relegated to the background. War service of one kind or another absorbed the full energies of the organization's staff and of its officers and members. Aside from this period of national crisis, however, the main activity of the Institute has been directed to fulfilling the purpose of its founders by promoting the study of the arts and sciences connected with petroleum. In its earlier years much of the effort of the organization was directed to introducing orderly methods and standardized practices into what had been a somewhat chaotic field of industry. As an example, one accomplishment that has been the means of tremendous savings to the industry while greatly simplifying its operations has been brought about by the special committee on standardization, operating under the Division of Production. Prior to its organization there had been no uniformity in the materials and construction of drill pipe, casing and other field equipment. Operators ordering replacements never could be certain that the parts sent them would fit those they had in use or be of exactly the same quality. As a result of the standards worked out over a period of years for pipe threads, joints, tubing and other equipment, API specifications are known and followed throughout the oil world. Similarly codes of practices in the measuring and sampling of products, in drilling procedure and in various other operations have been established. In other phases of industry operations, fire prevention and safety measures have been recommended and have greatly reduced the accident rate in fields and refineries. Uniform accounting methods for meeting the special problems of the oil industry such as charges for depletion and depreciation and the valuation of intangible assets have been proposed and adopted. Research activities have not been neglected and many studies have been conducted in conjunction with technical organizations in other industries on problems of common interest. These are a few of many activities covering a wide range that have been carried on by the Institute or under its direction in furthering the technological progress and operating efficiency of the oil industry.

Now, after more than a quarter century of successful effort in promoting the arts and sciences connected with petroleum the Institute is entering upon a new era of broadened activity and

Edwin S. Hall, Standard Oil Co. of New Jersey, chairman of the American Petroleum Industries Committee.

Dr. Fred H. Lahee, Sun Oil Co., chairman of the Committee on Reserves.

L. S. Wescoat, Pure Oil Co., chairman of the Highways Committee.

B. I. Graves, Tide Water Associated Oil Co., chairman of the Standing Committee on Public Relations.

George Krieger, Ethyl Corp., chairman of the Committee on Agricultural Development.

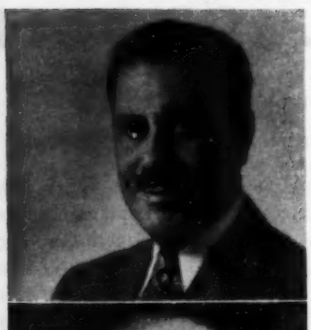
W. Alton Jones, Cities Service Oil Co., chairman of the Aviation Committee.

Above: E. G. Gaylord, Standard Oil Co. of California, chairman of the of the Research Advisory Committee

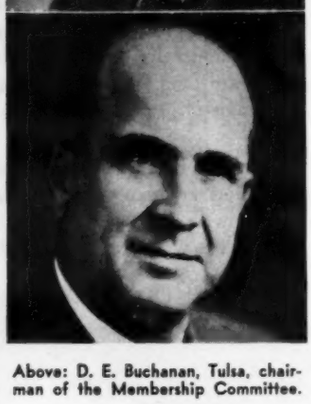
Below: T. E. Swigart, Shell Pipe Line Co., chairman of the Pipe Line Study Committee.

Above: E. C. Peet, Shell Oil Co., chairman of the Financial and Accounting Committee.

Below: A. J. McIntosh, Socony Vacuum Oil Co., chairman of the Statistical Advisory Committee.



Above: D. E. Buchanan, Tulsa, chairman of the Membership Committee.



Below: Charles A. Miller, The Texas Co., chairman, Accident Prevention and Safety Advisory Committees.

greater service to the oil industry. It is becoming more widely representative of the industry as a whole. It is extending its attention to new fields such as agriculture. It is studying the question of the industry's public relations. It is providing special recognition for conspicuous service to the industry whether rendered by its own members or others. The broadening of the Institute's scope and influence through these and other related steps is the special concern of President William R. Boyd, Jr., based on his intimate contact with Institute affairs over almost the whole period of its existence. He looks upon their establishment on a firm basis as the culmination of his long and distinguished service to the industry.

Under the charter of the Institute its governing body is the Board of Directors. Directors are elected for two year terms half of the board being renewed each year. At the time of its organization the board consisted of forty members most of whom had served on the Petroleum War Service Committee of World War I. As the membership of the Institute grew from its small original group to its present number of 4,700, the board has been enlarged from time to time until it now totals 133. In the process of expansion it has taken on more and more members connected with phases of industry operation not originally represented. During the past year, in furtherance of the policy of making the organization more completely representative a resolution has been adopted by which the executive heads of a number of sectional and group associations automatically become directors.

Since a body of this size obviously cannot undertake the direction of the Institute's detailed operations, this function is delegated to an executive committee of 25 members elected by the board. The executive committee meets at the call of the President. Management of the Institute is in the hands of the president, four vice president, one each for production, refining, transportation and marketing, a secretary, treasurer and assistant treasurer. The operating staff which has increased with the growth of the Institute now numbers 130. Offices are maintained in New York and Washington, the president dividing his time between the two. Headquarters for the Division of Production are located at Dallas, Texas, to permit closer contact with the main producing section of the country. A statistical office is located in Los Angeles, California.

Five general departments are maintained, each operating under a director who is a member of the organization's staff. These are the Department of Engineering, the Department of Information, the Department of Accident Prevention, the Department of Statistics and the American Petroleum Industries Committee which specializes on the subject of taxation. Aside from these specialized activities the work of the Institute is carried on mainly through its large number of committees, the only feasible plan in view of the large membership composed of men whose energies are primarily directed to satisfying the demands of their professional or management positions.

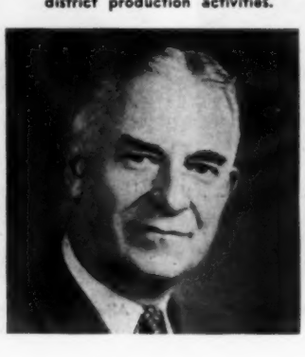
Early in the history of the Institute it was recognized that most effective action could be achieved through small working groups. In a world-wide industry in which hundreds of thousands of men are engaged not many questions can be settled in mass meetings. Plan of the Institute, therefore, was to get the work of the organization done by relatively small committees of men who were most specifically equipped to solve intricate problems. In practice, this has led to organization of a very large number of subcommittees which have reported through parent committees to divisional organizations and thence to the board of directors for approval.

Recently Dave Stroop, assistant to President Boyd, was asked how many individuals have served on API committees and subcommittees since the Institute was organized 26 years ago. He spent a full day in his records and came up with a figure of 15,000. That seems like a lot of men but Stroop backed it up with records showing that today there are 200 committees and subcommittees at work within the framework of the Institute and that the total membership of these groups is approximately 3,000.

Organization chart of the Institute shows nine primary standing committees which report direct to the president and the board of directors. These are: The American Petroleum Industries Committee of which Gen. Baird H. Markham is director; the committee on reserves, committee on agricultural development; committee on aviation; committee on highways; committee on public relations; committee on research; financial and accounting committee; membership committee and pipeline study committee. Safety and fire prevention activities of the Institute are classified as a

Dr. McIver Woody, Standard Oil Co. of New Jersey, chairman of the Medical Odvisory Committee.

V. F. Bowyer, Peoples Natural Gas Co., chairman of the committee on district production activities.



S. E. Buckley, Humble Oil & Refining Co., chairman of the committee on Drilling and Production Practice.

department but actually differ little from the primary standing committees just mentioned.

Two of the major steps taken by the Institute this past year to enlarge the scope of activity were to set up an Agricultural Development Committee and to consolidate all transportation activities in a newly created division with offices in Washington, D. C. The new division functions under B. Brewster Jennings of Socony Vacuum Oil Co., who was elected as a fourth vice president.

George Krieger of Ethyl Corporation is chairman of the new agricultural development committee, which was organized in recognition of the interdependence of the farmer and the oil man. The farmer now consumes more than 3.5 billion gallons of petroleum yearly. There now are 2,200,000 tractors on American farms. This number is expected to increase at the rate of at least 10 percent per year during the next decade. The growing mechanization of agriculture also is seen in the fact that 34.5 percent of the nation's motor trucks are used by farmers. A recent survey reveals 13,000,000 potential farm users of liquefied petroleum gases for cooking. LPG is used also for weed eradication and various other purposes. Great quantities of grease and oil are used on the farms to lubricate farm machinery. Insecticides, fungicides and fertilizers, manufactured from petroleum's growing chemical operations, bid fair to be an important part of the oil industry's future business.

Purposes of the new committee are:
(1) Research into materials combining products oil and the farm.
(2) Study of insecticides, fungicides, weed destroyers, fruit ripeners, liquid fertilizers and similar chemical products for the farm which may be manufactured from oil.
(3) Furtherance of soil conservation and fertility maintenance.
(4) Study of efficient and profitable farm mechanization.

Chairman Krieger of the new committee has been in charge of farm research for Ethyl Gasoline Corporation since 1930 and has spent his entire business life in agricultural engineering. During the war he assisted WPB Chairman Donald Nelson on farm problems as director of the WPB farm machinery and equipment division.

Organization of the committee was completed at Washington last April. Additional meetings have been held at approximately monthly intervals since that time. Program of the Institute's annual meeting at Chicago includes an entire session on November 11 devoted to agricultural development.

Research activities of the Institute under the leadership of J. Howard Pew of Sun Oil Company have been one of its most important continuing activities. The Institute has directed a vast amount of fundamental research in various

F. E. Rice, Phillips Petroleum Co., chairman of the Committee on Measuring, Sampling and Testing of Natural Gas and Natural Gasoline.

J. Edgar Pew, chairman of the Committee on Standardization of Oil Field Equipment.

H. Levin, The Texas Co., chairman of the Committee on Analytical Research.

universities and research laboratories in addition to the research into immediate problems of a more practical nature. Of the two principal advisory committees of the primary standing committee one is charged with investigating the occurrence and recovery of oil and the other is charged with research into the composition and properties of petroleum.

World War II provided a striking example of the value of the Institute research program. With the industry called on for 60 percent of the tonnage of war supplies and the production of new chemicals in vast quantities it became necessary to achieve new accuracy in test methods. Mass spectrometers and similar devices had been developed but they were only as accurate as their calibration which was in turn dependent on purity of the standard samples from which it was determined.

At the beginning of the war standard samples of only a dozen hydrocarbons of 99 percent purity were available. It was determined that 119 such pure hydrocarbons were needed. API Project 46 "Hydrocarbons for Spectrometer Calibration" was undertaken and under this project the research efforts of some 20 laboratories was diverted from fundamental peacetime work. Ohio State University dropped its current API project and came up with 16 pure hydrocarbons. Pennsylvania State College added more. Today the list of 119 has been completed or are in final stages of preparation and the list now has been increased to 192. In the two year period ending June 30th, API Project 46 has provided 2,062 standard samples. Some of these samples are among the word's most rare and expensive liquids costing as much as $35,850 per gallon to produce. Others have been supplied at prices as low as $18.00 to $50.00 per sample of 3 pints.

Top: K. G. Mackenzie, The Texas Co., chairman of the Committee on Automotive Research.

Below: A. E. Pew, Jr., Sun Oil Co., chairman of the Committee on Refinery Equipment.

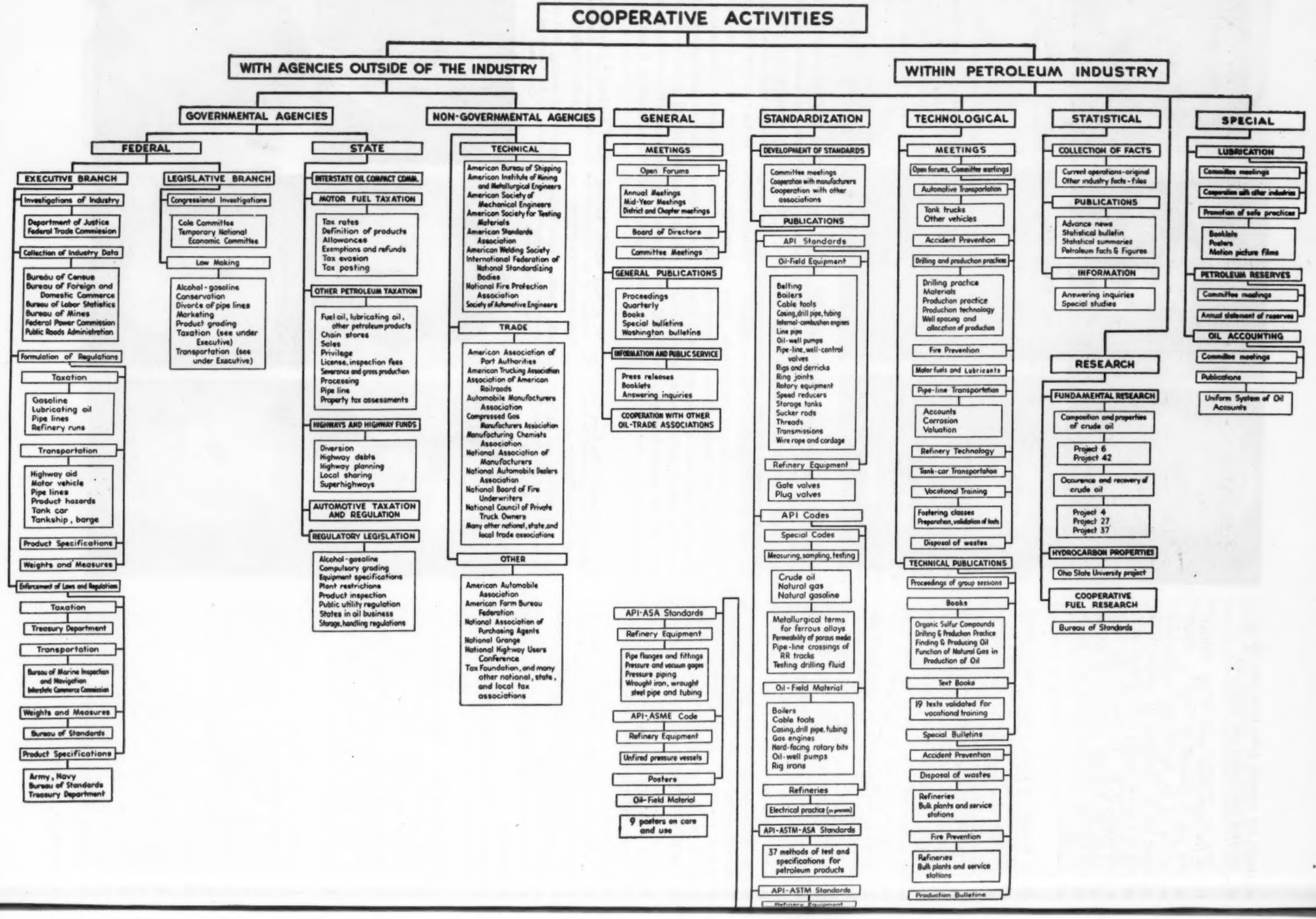
Top: W. B. Hart, Atlantic Refining Co., chairman of the Committee on Disposal of Refinery Wastes.

Below: A. E. Miller, Sinclair Refining Co., chairman of the Technical Oil Mission Study Group.

Top: J. B. Rather, Socony Vacuum Oil Co., Chairman of the Committee on Petroleum Products.

Below: V. J. McCoy, Shell Oil Co., chairman of the Vocational Training Committee.

FUNCTIONS AND ACTIVITIES OF THE AMERICAN PETROLEUM INSTITUTE



A very large number of committees and subcommittees are appointed within the four major divisions of the Institute, each of which is headed by a vice president. Divisions are Marketing under Eric V. Weber of Eureka Oil Co., Cincinnati, Ohio; Production under George A. Hill, Jr., of Houston Oil Co.; Refining under J. Howard Pew of Sun Oil Co.; and Transportation under B. Brewster Jennings of Socony-Vacuum Oil Co.

Production division has been active for many years in promoting better drilling and producing practices through meetings of field engineers and operators in various sections of the country. Four district organizations have been active, one in California, one on the Gulf Coast, one in the Mid-Continent and one in Eastern fields. Now that new interest is developing in the Rocky Mountains a district organization is being set up there.

Under the districts are 23 field chapters which meet regularly. Nine more are being organized. In the first quarter of this year, for example, 19 chapter meetings were held with an aggregate attendance of 1,894. At these meetings 22 papers were presented dealing with practical field problems. In 1945 there were 38 chapter meetings with 3,620 in attendance. These chapter meeting are in addition to the district annual meetings which bring out a large attendance. Last spring the southwestern district meeting at Shreveport was attended by 600; the Mid-Continent meeting at Oklahoma City brought out 450; the Eastern district at Pittsburgh 500. The Pacific Coast district at Los Angeles had a registration of 1,100.

Much of the industry's advance in refinery practice may be attributed to the work of the large number of committees and subcommittees in the Institute's refining division under J. Howard Pew. Fundamental research has been mentioned previously. Other important committee work involves vocational training, refinery equipment, disposal of wastes and, of course, improvements in products themselves. Following the retirement of Dr. R. P. Anderson as director of the refining division last year William T. Gunn was employed to coordinate the various activities of the division and the important liasion work with other bodies. Mr. Gunn formerly was assistant to K. G. Mackenzie of The Texas Company.

The marketing division has done notable work through the years in promoting better lubrication of automotive and other machinery. "Lubricate for Safety" has been a slogan which the division has pushed. This year two general meetings have been held to study marketing problems including the surprising extent of this year's demand and the probable level of demand for various products during the next five years.

(Continued on page 103)

F. B. Hufnagel, Jr., Sun Oil Co., chairman of the Automotive Transportation Committee.

C. H. Kountz, Sinclair Refining Co., chairman of the Pipeline Transportation Committee.

Fayette B. Dow, National Petroleum Association, chairman of the Railroad Transportation Committee.

H. G. Schad, Atlantic Refining Co., chairman of the Committee on Transportation by Water.

L. C. Welch, Standard Oil Co. (Ind.), chairman of the Lubrication Committee.

M. W. Morris, Standard Oil Co. of California, chairman of the Pacific Coast Production District.

W. V. Vietti, The Texas Co., chairman of the Southwestern Production District.

H. S. Kelly, Phillips Petroleum Co., chairman of the Mid-Continent Production District.

W. J. Sweeney, Standard Oil Development Co., chairman of the Research Advisory Committee on Composition and Properties of Petroleum.

R. T. Haslam, Standard Oil Co. of New Jersey, chairman of the Advisory Committee on Public Relations.

J. E. Moss, director of the new Transportation Division.

Wm. T. Gunn, recently appointed director of the Refining Division.

BRAZIL'S LATEST DISCOVERY SPURS INTEREST IN OIL DEVELOPMENT

IN mid-September the Brazilian public was electrified by the news of an important find of petroleum in the Bahian Reconcavo district, where on September 16 a well was brought in that blew a column of liquid 330 feet into the air. When brought under control and gauged through a ¾" bean, the new well flowed at the rate of 1800 barrels a day.

The significance of this discovery to the Brazilian public lies in the fact that until a few years ago that country had no native source of petroleum and was entirely dependent on imports for its supply of motor fuel, fuel oil, lubricants and other petroleum products.

This lack of oil was responsible for an onerous situation in Brazil's national economy; the demand for gasoline was large and increasing, and the need for foreign credits was correspondingly large. The situation might have been different if foreign capital had been allowed to explore the Brazilian subsoil for petroleum but the Brazilian constitution expressly prohibited foreigners from owning or operating oil wells.

With foreign capital thus shut out the Brazilian public could expect only their native capitalists to undertake the risks of exploring for oil in their country. But the native capitalists would not enter the field, not so much for lack of funds as because of unfamiliarity with the operations of the industry. Brazil did not have enough men trained in the technology of oil exploration and production to launch oil enterprises on the necessary scale. This being the case the government entered the field with taxpayers' money and established the National Petroleum Council to direct the search for oil resources. The Council in turn engaged the services of North American experts to make geophysical surveys and to drill test wells in selected areas. A modest program was undertaken which resulted in the discovery of several small oil and gas fields in the Bahia region.

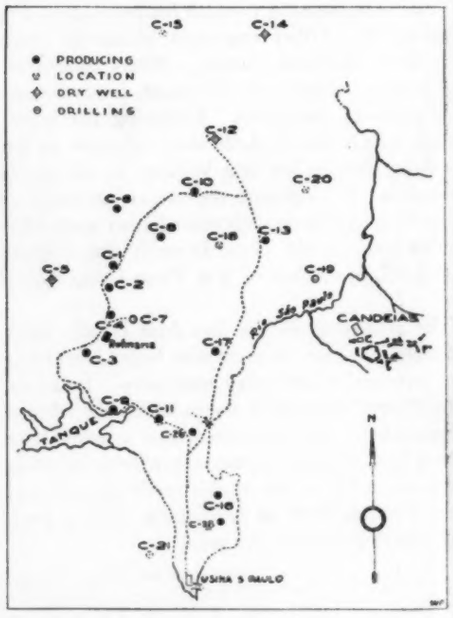
Drilling has been carried on at a number of points in Bahia over the past five years and has resulted in the location of four fields with some 30 producing wells. The fields are Labato, where the first important showing of oil was found; Aratu, where two producing horizons were located, one yielding oil and the other gas; Itaparico, on the island of that name opposite the city of Salvador, and Candeias which is northwest of the city and slightly further inland than the others. None of the earlier wells were large producers and their combined output has not exceeded 2,000 barrels daily. Study of the formations indicated, however, that larger production could reasonably be hoped for, particularly on the Candeias structure. It is in this field that the new and most significant discovery has been made.

Considering the eagerness of the Brazilian public to have an indigenous petroleum industry capable of meeting the country's needs, the public enthusiasm aroused by this discovery is understandable. There was a great rush of journalists and photographers to the scene, and sightseers came from afar. Statisticians did some calculating. A production rate of 1800 barrels a day corresponds to about four percent of Brazil's present annual consumption; 25 more such wells and Brazil would be self sufficient in petroleum!

The new well, while not an extraordinary phenomenon, would be regarded as a good find in any oil country. It is located in the Candeias field, in the Reconcavo district, about 75 kilometers north of the city of Salvador. Its official designation is C-26. The well was spudded in on August 14 by J. Lewis, an experienced American oil driller. The rig was set up in 48 hours and just a month later, on September 15, the drill reached a depth of 772 meters (2525 feet). The producing zone is compressed between 695 and 757 meters, so the pay is 200 feet thick. A string of 10¾" casing was set at 82.5 meters, and

One of the wells drilled in the Bahia region of Brazil. In the foreground is J. E. Brantly, President of Drilling and Exploration Company

Map of Candeias field



Map of Brazil Showing Location of Four Producing Fields thus far Developed and Location of Unsuccessful Exploratory Work.

a 5½" string at 703 meters. The oil string extends to 698 meters, just topping the pay. The first flow test, lasting an hour and 45 minutes, produced 235 barrels through a ¾" valve. The second test (16 hours) yielded 1271 barrels, and the third (24 hours) 1800 barrels, all though the same ¾" valve. The Conselho Nacional Petroleo conservatively estimates the average potential at 1500 B/D. At prsent the well is closed in, awaiting tankage and other facilities. Drilling was done under contract by the well-known American firm, the Drilling and Exploration Co.

The cost of drilling C-26 was Cr$600,000 or $30,000 in U. S. currency. There are some 16 other producers in the area, with an average daily production of approximately 60 B/D, ranging from 25 to 100 B/D. These wells are said to be producing from the same zone as C-26.

The Conselho Nacional Petroleo is proceeding swiftly to follow up what the Brazilian press hails as its "astonishing victory." C-26 will give the Conselho a large increase in its cash income. The day following the discovery President Dutra signed a decree converting the Conselho Nacional Petroleo into a corporation with a capital of Cr$50,000,000 ($4,161,000 U. S.) and authorizing it to form a "mixed company" with the participation of native capitalists, who will hold half the stock and the Conselho the other half. The new company will proceed at once with the erection of a 2500 B/D refinery in the Bahia district. Tubular goods for pipe lines and casing are being accumulated and arrangements are being rushed for road building and other facilities for an extended drilling program. New drilling is projected for the Labato, Joanes, Aratu and Itaparica districts of Bahia.

Further evidence that substantial production is to be expected from the Candeias field is provided by the announcement of the National Petroleum Council that since the completion of C-26 another well that ranks only a little below it has been brought it. The latest well is designated as C-28. Its depth its 2560 feet and the producing zone is between 1930 and 2466 feet. On the first 24-hour test, on October 8, through a ¾" valve, the well yielded 1032 barrels. Its estimated potential is placed at 1,000 barrels daily.

The problems involved in locating the productive sections of an oil field are well illustrated by the history of Candeias. The first well was drilled in 1941 and was put down to approximately 6,000 feet, the limit that could be reached with the small rig used. It yielded only small showings but provided useful geological information. It revealed the existence of alternate strata of sandstone and shale and, below one of the latter, a layer of oil sand about fifty feet in thickness at 3800 feet. A drilling pattern was then set up for the systematic exploration of the section. Since that time, as the numerals indicate, 26 additional wells have been drilled. Something less than one-half of these have produced oil but only in small quantities, ranging from 40 to 200 barrels per day. As the tests have proceeded thicker and more productive lenses of oil sand have been encountered and the showings of the two wells most recently completed indicate that the most productive section of the field has now been located. There is still a feeling among Brazilians that for an early and complete solution of Brazil's petroleum problem it will be necessary in one way or another to admit outside capital and technical skill to cooperate in the development of of the nation's oil resources. International oil companies, many of which have had vast experience with oil production, not only in the United States but also in many lands throughout the world, are still the chief reservoirs of large reserves of capital awaiting opportunity to invest in new oil enterprises, and also are the chief repositories of technical knowledge and skill in the intricacies of exploring and drilling for oil. With their technological resources and their ample staffs of experienced personnel these concerns could hasten the finding of undiscovered resources.

Heretofore an insuperable obstacle to the entry of foreign capital into the country's petroleum affairs has been the Brazilian constitution, which expressly reserved exploitation of all mineral resources to native Brazilians, even excluding persons of foreign birth who became citizens.

However, a new constitution for Brazil was promulgated on September 18, 1946, just two days after the gusher C-26 was brought it. In Title V of this document, which deals with economic and social matters, Article 153 *et seq.* provides that mines and other resources of the subsoil, including sources of water, shall be considered as distinct from property in the soil; that use of mineral resources shall depend on authorization or concessions granted by federal law, and that these authorizations shall be made exclusively to Brazilians *or to enterprises organized in the country*, with preference being given to the proprietor of the soil. These provisions have been interpreted to mean that while an individual operator of a mine or other form of production from the subsoil must be a Brazilian, any one may participate in a corporation organized under Brazilian law for the same purpose.

This would seem to give outside capital an opportunity to engage in the Brazilian oil industry, depending on what conditions the federal authorities write into the charter of the corporation within the forms to be prescribed by the Congress.

This seems to be the interpretation put upon the constitutional aspects of the matter by Brazilian Minister of Foreign Affairs Joao Neves, in an official release on the Anglo-Brazilian accord recently signed in London on September 21, 1946. The same construction has been put upon it by a number of international oil men who are showing keen interest in the new situation.

Brazilian officials before whom such matters would come have stated, off the record, that they expect applications from a number of groups.

RESTORATION OF EAST INDIAN FIELDS REQUIRES VAST AMOUNT OF EQUIPMENT

IN response to many inquiries officials of the Royal Dutch Shell Group have issued a report outlining the effect of Japanese occupation upon their properties in the East Indies and the steps that are being taken to repair the damage inflicted. The report is necessarily incomplete. Owing to disturbed conditions that still exist in some of the affected areas it has been impossible to gain access to certain localities or to determine exactly the state of the installations in such regions. In general, however, the information obtained shows that the work of destruction carried out by employes of the operating companies at the time of the enemy invasion was very thorough. Allied bombing of enemy held installations and destructive measures applied by the Japs upon their withdrawal added to the demolition so that a long period of time and a vast expenditure of money will be necessary to restore the fields, pipe lines, refineries and storage facilities to their pre-war productive capacity.

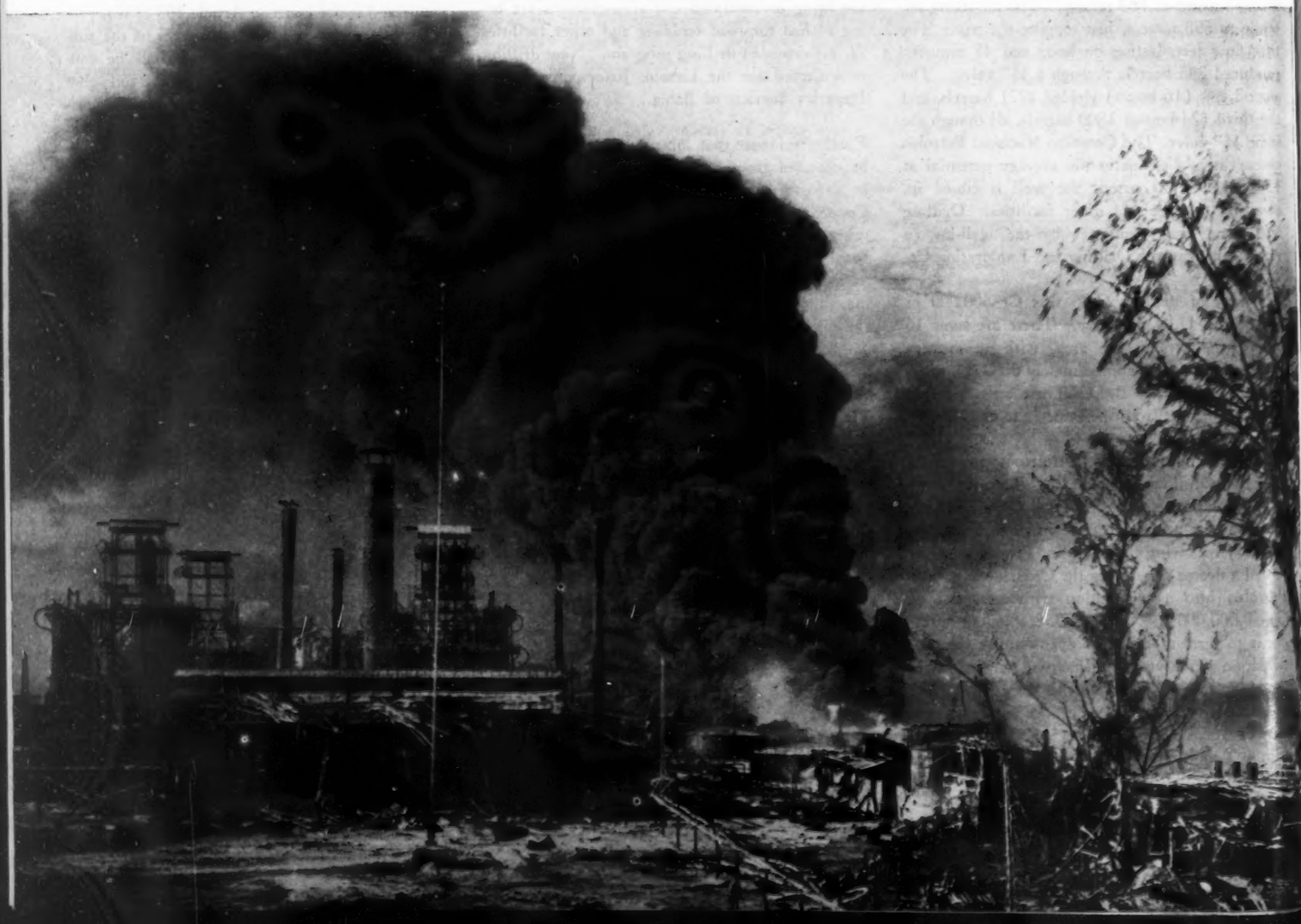
The first oilfields to be invaded by the Japanese were those of British and Dutch Borneo. Acting in accordance with prearranged plans the refineries at Sarawak and Balikpapan and the wells at Miri, Seria and Tarakan, together with all the accessory facilities, were destroyed by fire or explosives in the face of the enemy advance. At Tarakan, for example, some 400 wells were put out of commission by setting off charges of dynamite or dropping tubing into the holes; the pumping equipment and tanks containing over 700,000 barrels of oil were blown up. Similar treatment was given to the smaller fields at Boela, on Ceram, and at Babo in New Guinea.

The largest operations of the Royal Dutch Shell Group in Netherlands India were those conducted on the island of Sumatra where the Pladjoe refinery of 56,000 barrels daily capacity was located in the southern part of the island and a 22,000 barrel plant was situated at Pangkalan Brandan on the northeastern coast. A Japanese paratrooper attack on Pladjoe in February 1942 prevented the full destruction of the plant that had been planned but the northern refinery was demolished before the enemy reached it.

On the island of Java the group had some small fields and two refineries of about 8,000 barrels combined daily capacity. One of these is believed to have been destroyed by Allied bombers; the other was brought back into partial operation by the Japanese during their occupation.

Since the East Indies offered the only possible source from which the Japanese could hope to obtain petroleum supplies to carry on the war they naturally exerted every effort to reestablish production. They shipped in drilling crews and equipment and endeavored at put some of the refineries into partial operation. In the Tarakan area they drilled 173 new wells. Because of

Shell Oil Company refinery at Balikpapan, Borneo, which was destroyed by employees to prevent its use by the Japanese and now must be rebuilt. Official Netherlands photo.



the ease of drilling in the Borneo fields and the fact that they were nearer to Japan than any of the others they received special attention from the invaders and it is estimated that possibly 5,000,000 barrels were extracted during the period of occupation. In the Tandjoeng field southwest of Balikpapan where no refining equipment had been installed at the time of occupation they constructed a makeshift topping plant where, it is estimated, they processed during one period perhaps 1,000 barrels per month. At Pladjoe, in Sumatra, they were able to obtain substantial production from the fields within a year after their capture and kept the refinery in operation though much below its capacity. Until Allied bombers practically cut off Jap contact with the island, following the landing in the Philippines this apparently was the most important single source of supply for the Japanese. They added a coke plant to the refinery and completed it in December 1944, but in the following month when it began operation it was put out of action by Allied air attacks. In northern Sumatra the Japanese obtained production from the Rantau field and from a comparatively new development at Paloeh Taboehan and it is estimated that they may have taken between 8,000.000 and 9,000,000 barrels out of these areas. They found time to do some wildcatting, putting down one well near Tandjong Porva near Paugkalan Brandan and preparing the site for another near Pelawan. After the start of Allied bombardment, in January 1945, they attempted to transfer some of the refining equipment from Pangkalan Brandan and to set up small topping units at Sawit Sabrang and Lamgsa but it does not appear that these were of much use to them. The storage installations at Pangkalan Soesoe, a short distance from the refinery, which had a capacity of 2,500,000 barrels, were largely demolished by Allied bombers.

In Java the invaders drilled a number of wells in the Kawengan and Rembang areas and in the small fields around Soerabaya and were able to put the Tjepoe and Womarkrome refineries into partial operation. The latter plant has disappeared but whether it was removed to a new site or destroyed by Allied air attack has not been determined. Japanese takings from the Java fields are estimated as amounting possibly to 10,-000,000 barrels.

While estimates of the amount of oil taken by the enemy from the East Indies are by no means exact since it has been impossible to examine the present condition of many of the wells the following table showing 1941 production in the Dutch possessions and the calculated annual production during the period of occupation based on the information now available will give an approximation of the extent of their operations:

ANNUAL CRUDE PRODUCTION IN N.E.I.
(In U.S. Barrels)

Area	1941	Under Japanese Occupation	Percent of 1941
Tarakan	4,730,000	1,493,000	32
Pladjoe	16,631,000	10,044,000	60
P. Brandan	5,853,000	2,613,000	45
Java	4,503,000	3,266,000	72
Known areas	31,717,000	17,416,000	55
Balikpapan	6,819,000	unknown	
Ceram	697,000	unknown	
Grand Total	39,233,000		

All the evidence indicates that the Japanese were fully informed as to conditions in the various oil producing regions of the Pacific and that they had made large scale advance preparations for exploiting the petroleum resources of these areas. The fact that they devoted intensive efforts to the Pladjoe and Java districts where flowing wells predominate indicates that advance plans had been made to concentrate on such wells.

The first old areas recovered were those of Miri and Seria in British Borneo, which were recaptured from the Japanese in July, 1945. The enemy in his retreat had fired the flowing wells at Seria and blown up all major installations. By

Pump stations and other oil field installations were carefully destroyed in the Tarakan field on Borneo before the Japs could take posession.

the end of September 1945, all fires had been extinguished and rehabilitation in the fields was proceeding, while reconstruction of the badly damaged refinery at Lutong had been started. Drilling was resumed early in 1946 and regular shipment of crude oil from the area began in March. Present daily production is 10,600 barrels, which is expected to increase substantially by the end of the year.

Tarakan was reoccupied in May, 1945. Repairs started immediately and production was resumed as early as June, 1945. By the end of 1945 some 255 wells were ready to be put into production. The scarcity of material and supplies hampered speedy rehabilitation. It is expected, however, that it will be possible to increase the storage and pumping facilities to such an extent that by the end of 1946 a quantity of 30,000 metric tons, or 50 percent of the prewar figure, can be handled. When, in 1945, Allied troops recaptured Balikpapan, the Japanese destroyed everything they had rebuilt which had escaped Allied bombing. One crude oil distilling unit with a capacity of 4,200 barrels daily has been repaired and is operating. A second unit of the same capacity will be put into commission shortly and preparations are under way to further increase the distilling capacity.

In order to be able to handle the oil, two 30,000 barrel tanks for diesel oil and two of the same size for boiler fuel were repaired and by the end of May it was possible to handle oil from and to ships over two wharves. A loading speed of 6,000 barrels per day was obtained. Before the war, the Sanga Sanga, Anggana and Sambodja fields produced approximately 2500 metric tons of crude daily, from some 450 wells. Practically all wells were wrecked and, therefore, a tedious and enormous task of repair lies ahead. The rehabilitation work started much later than at Tarakan but at present eight repair crews are rehabilitating the damaged wells. At Sanga Sanga the Japanese had constructed three large earthen reservoirs for crude oil storage, the contents of which are now gradually being pumped into tanks. A total of 225,000 barrels has been recovered in that way.

The Tandjoeng field, situated approximtely 120 miles southwest of Balikpapan was undamaged. This field was opened shortly before the outbreak of war and since facilities for gathering and transporting oil from the eight flowing wells to the nearest refinery or shipping point had not yet been erected at the time of the Japanese invasion the field was of little use to the Japs, and the wells were left intact.

Although extensive repairs will be required at Pladjoe it appears probable that most of its installations can be used again. It has not yet been possible to investigate the condition of the wells in this region so that it is not known whether the Japanese obtained a high rate of recovery by opening up the flowing wells without regard to ultimate recovery. Some 60 wells were drilled, however. Owing to political disturbances the operating personnel of the companies have not been able to make an accurate survey of fields in Sumatra.

Under present conditions it is impossible to predict when the rehabilitation of the Sumatra and Java oilfields will commence. Plans have been worked out to resume drilling in these regions with 15 strings. Moreover, refining equipment as well as plants to improve the quality of products have been ordered and are ready to be moved into the area as soon as conditions permit.

In the Borneo area an 8-string drilling program is visualized while in New Guinea the exploratory campaign will be resumed with at least four strings. Fortunately, no political difficulties are encountered in these areas.

The amount of materials and equipment required of the East Indian archipelago will largely depend on the state in which the refineries and settlements on Sumatra will be found. According to the preliminary estimates a total of approximately 200,000 tons of equipment, machinery and materials will have to be procured. To a large extent these materials have been indented but currency exchange difficulties have an appreciable influence on the choice of manufacturers and thus on the speed of delivery. A further contribution to the difficulty of material supply is the uncertainty whether cement and other materials, especially those for building and oil engineering, which previously were purchased locally, will be available again in sufficient quantities.

It is estimated that 600 pumping units will be required for the preliminary construction program. On order are 30 power generating units with an aggregate performance of 40,000 Kw. Approximately 200 miles of piping will be needed for drilling and well finishing purposes. As to pipelines and gathering systems it is most uncertain as to what size quantities will ultimately be necessary for rehabilitation, as reliable information for several areas is still lacking. Before the Japanese invasion, roughly speaking, 3000 miles of pipelines of 4" and larger diameter were in operation in fields, refineries and interconnections.

It is certain that the percentage of storage capacity to be replaced will be far in excess of the percentage of pipeline length to be reconstructed. Before the invasion approximately 20,000,000 bbl. of storage capacity was available.

In spite of the hampering effect of the shortage of some essential materials and of currency difficulties, the Royal Dutch Shell Group is now actively engaged in organizing the gigantic task of rehabilitating, in a few years, the destruction caused by a wanton enemy to fields and refineries which took many decades to build.

HUMBLE CONSIDERS ERECTING GAS CONVERSION PLANT ON GULF COAST

RECENT developments suggest that the commercial manufacture of gasoline from natural gas may be expected to progress rapidly in the immediate future. In addition to the Hydrocol plant now being built in the Brownsville, Texas, area two plants are being considered for construction in the Hugoton gas field extending from western Kansas to the panhandle of Texas.

An official of Humble Oil & Refining Company told a group of newspaper men recently that Humble is giving serious consideration to the erection of a gas conversion plant on the Gulf Coast. He did not indicate the proposed location. It was stated, however, that company technologists view natural gas reserves as being approximately equal to crude reserves as a source for future motor fuel supplies. This view has been reached through pilot plant operations on a semi-commercial scale at a Gulf Coast refinery of Standard Oil Co. (N. J.) In common with most other large companies in the oil industry, Jersey is devoting a very considerable portion of its research and development work to gas and coal conversion processes.

In common with other operators of cycling plants in the Gulf Coastal areas of Oklahoma and Texas, Humble is carefully conserving gas as a reserve of motor fuel raw material. At current prices natural gas at the wellhead in Texas is bringing only about ten percent of its Btu. value when compared with liquid fuel. Because of this some producers now resent the necessity of selling any gas which can be put into formation for future recovery.

About the time the Humble official was revealing his company's plans, E. V. Murphree, executive vice president of Standard Oil Development Co. told the American Gas Association that conversion of gas to motor fuel now is economically competitive with gasoline from crude oil. In fact, he said, gasoline from natural gas may be a little cheaper than from crude at present crude prices. He revealed that development during the war of processes using moving catalysts is primarily responsible for the economic conversion of gas and coal to liquids.

One feature of the fluid catalytic cracking operation which is of great importance in gas conversion processes is that although large heat effects are involved the temperature of the fluidized catalyst beds is essentially uniform, Mr. Murphree told the Gas Association. Following is a portion of his paper:

In the regenerator of a typical commercial gas conversion unit the heat evolution may amount to 200,000,000 Btu. per hour and yet a temperature difference of greater than five degrees has not been observed in different parts of the bed. The reason for this uniform temperature is the turbulence of the catalyst mass, which means that there is very rapid mixing which tends to equalize any differences in temperature which would otherwise exist. Because of this feature of easy temperature control, the fluidized solids technique should have wide application for all types of catalytic operations involving treatment of gas or vapor with a solid catalyst, or for other types of operations involving handling solids where it is desirable to maintain uniform temperatures. This is particularly true if large heat effects are involved since it is possible to take out heat from beds of fluidized solids by means of cooling tubes with high temperature differences and still maintain uniform bed temperature.

The conversion of natural gas or coal into liquid products by the Fischer-Tropsch synthesis or its modifications is based first on producing a mixture of hydrogen and carbon monoxide from the gas or coal, and then reacting this mixture over a solid catalyst to give synthetic hydrocarbons. In the synthesis step proper a large amount of heat is evolved, amounting to about 1,800,000 Btu. per barrel of liquid products produced. In the Fischer-Tropsch operation as developed in Germany, catalyst was used in pelleted or granular form, the catalyst being stationary. In order to remove the heat, various types of reactors were used, one form of which involved having the catalyst in the annular space between cooling pipes where the thickness of the catalyst layer between the cooling surfaces was not over ½ inch. The capacity of the equipment was limited to ability to remove heat. For a plant to produce 10,000 B/D of synthetic hydrocarbons, using the German design, 128 reactors would be required having a cooling surface of 5,800,000 sq. ft. By use of catalyst in fluidized beds, similar in principle to that employed for catalytic cracking, it is possible to reduce the number of reactors to four and the total amount of cooling surface to 250,000 sq. ft. That is, it is possible to reduce the cooling surface by a factor of over 13, which means a large reduction in maintenance and operating cost. The use of catalyst in fluidized form in the Fischer-Tropsch process has been one of the outstanding advances in making this process commercially interesting in the United States for conversion of gas and coal into liquid products. There have been advances, too, in the types of catalysts used. The catalysts used by the Germans gave very paraffinic products, and the gasoline obtained was low in octane number. Improvements have also been made in methods of producing synthesis gas. One process for production of synthesis gas being considered commercially for both natural gas and coal involves partial combustion with oxygen to produce the hydrogen-carbon monoxide gas mixture required. In the case of coal, of course, steam is used along with the oxygen.

From an economic standpoint production of liquid products from natural gas using a modified Fischer-Tropsch operation, appears reasonably attractive economically at the present time. The cost of producing gasoline in this way may be slightly lower than the cost of production of gasoline from crude oil. There is, however, a substantially higher investment involved in the production from natural gas. In the production of liquid hydrocarbons by the Fischer-Tropsch synthesis with coal, some light hydrocarbon gas is produced and this may either be converted back again to hydrogen and carbon monoxide or may be sold as high Btu. gas.

A plant to produce about 9,000 B/D of gasoline along with some 1,800 B/D of gas oil from coal, using the fluidized technique as discussed above, is estimated to cost roughly $42,000,000. In addition to the gas oil and gasoline produced, this plant would produce slightly under 40,000,000 cu. ft. of around 1,000 Btu. gas per day. If this gas is credited at 25c per 1,000 cubic feet and suitable credit made for the gas oil produced as well as certain chemicals, which will be discussed below, then the cost of gasoline from this plant based on coal at $2.50 per ton comes out to roughly 7¼c per gallon. This is not a great deal more than the cost of production of similar grade gasoline from crude oil at present crude prices. The investment, however, is much higher for the gasoline from coal plant than would be involved in making the equivalent quality of gasoline from crude oil, and the above cost includes no return on the added investment.

In addition to the other products produced from natural gas or coal, there are produced relatively large amounts of chemicals such as ethyl alcohol and higher alcohols, and in addition ketones and acids. In areas where these chemicals can be disposed of, their production represents an appreciable credit to either the natural gas or coal operation. It seems very likely in the future that chemicals produced in this way are going to have an important place in the organic chemical industry of the United States.

WORKING NEWSMEN SHOWN OIL FIELDS BY HUMBLE AND JERSEY COMPANIES

AT a recent meeting of public relations directors it was suggested that business should, in effect, open a press and public relations bank account and make regular deposits against the time when good will may be needed. The thought was that in an emergency these deposits will return both capital and satisfactory interest. Early in October Standard Oil Company (N. J.) and its affiliate, Humble Oil and Refining Company, opened such an account. The initial deposit was substantial in size, in keeping with the magnitude of the two companies and the payoff already has been impressive.

The Jersey-Humble experiment involved a 6,500-mile oil field inspection trip for 30 New York and Washington newspaper, press service and magazine writers. The cost was on the order of $600 per guest, plus thousands of man hours of preparatory work on the part of geophysical, geological, engineering and production executives and technologists as well as on the part of the public relations staff.

Immediate results have been dozens of intelligently written news stories in daily papers from coast to coast but of far greater importance is the fact that 30 newsmen on the staff of national magazines, press services and newspapers now have a considerable background of knowledge about the producing end of the oil industry and why it ticks. This background will be helpful in writing and editing oil stories for years to come. Their education was pedagogically correct in that it involved visual as well as aural impressions obtained under highly interesting circumstances. Everything the men learned could have been told them in New York or Washington by a lecture, assuming that the 30 men could have been gotten together and induced to sit still that long which is quite an assumption in itself. But not having seen a seismograph crew drill a row of shotholes, explode the dynamite and develop the seismic records; not having seen a rotary crew making hole on the King ranch or fishing for a lost bit 9,000 feet below a submersible barge anchored nine miles offshore in Galveston Bay; not having seen salt water being pumped back back into the earth in East Texas, the news men would clearly not have had the comprehension of the magnitude of the industry or its problems which they have today.

In addition to the correct pedagogy perhaps the most important element contributing to the success of the venture was the attitude toward the visitors displayed by top executives of the Humble company while the group was in the southwest. The newsmen left New York and Washington by chartered planes in the morning and were in Houston that evening. They were greeted at once by Harry C. Weiss, president; Hines H. Baker, executive vice president, and other Humble officials. But these men did not go back to their desks the next morning after a prefunctory greeting. They sat in every briefing session, rode the planes, busses, and boats with their visitors throughout the week. Mr. Weiss rode in Plane No. 1 on one leg of the trip and Plane No. 2 on the next leg. Always there was a vacant seat so that any member of the party could sit down and talk with him. The same was true of Mr. Baker, of Carl E. Reistle, Jr., manager of Humble s production department, Morgan J. Davis, manager of the exploration department, and dozens of other officials.

Plan followed was to brief the newsmen before each field trip telling them what they would see. These lectures were in recreation halls of Humble field camps and were illustrated with slides or carefully prepared wall charts. On the field trips themselves the visitors were permitted to see everything and ask any questions they wished. A photographer was along to take any picture requested by a member of the group.

Care had been taken by the public relations men to see that there was lots of good food (including beef) and good entertainment to enliven the trip. The first night in Houston there was a buffet supper and reception at which Humble and other Texas oil company officials and Houston newspaper and trade journal men met the group. The second day ended on the famous King ranch where the men were taken to see thoroughbred and quarter horses in action and lots of beef on the hoof. This was in the middle of the beef shortage back east. The Klebergs spread themselves as gracious hosts. The second day began on the ranch, was enlivened with barbecue, hot tamales and "mountain oysters" at lunch and ended with fried chicken in East Texas. Tyler's famous roses were pinned on lapels at the airport and heaped in profusion in hotel rooms. Back in Houston, Hughes Tool Company was host at a luncheon. At Galveston another steak dinner was dramatized with flaming baked Alaskas in

Left: Newsmen being addressed by Hines Baker, executive vice president of Humble. President Harry C. Weiss is on the front row.

Below: A map of the Gulf Coast salt domes was studied with interest.

the Balinese Room. In the swamp country of south Louisiana the newsmen toured the McIlheny tropical gardens on Avery Island after seeing how swamp buggies move on land and water and how canals must be dredged at a cost of $25,000 per mile before drilling can begin. At New Orleans the mayor presented visitors with keys to the city and the party ended with a dinner at Antoine's.

George Freyermuth, head of the Jersey company's department of public relations, and his assistants, particularly James Crayhon and David Davis began working on the trip at least six months ahead. Trips were made to Texas and the basic outline agreed to with W. N. Finnegan, Jr., Humble public relations man, and other officials. Department heads and division geologists and engineers set to work writing their talks for the briefing sessions. First drafts were reviewed by the public relations men and sent back to the various speakers with suggestions as to how the facts could be gotten across to laymen sometimes in less technical terms. Finally every talk was reproduced, complete with pictures and charts so that the newsman had his notes ready made.

In the oil industry there has been a great deal of talk through the years about the necessity of educating the public about the oil business. But through the years few companies have done a great deal in that direction. It has been something like Mark Twain's story about the weather that everybody talks about it and nobody does anything about it. A few years ago Shell showed newsmen how oil is processed in the refinery and the research applied to it and how Jersey and Humble have done the same thing with respect to oil production. In this case it should be pointed out that throughout the trip Humble and Jersey men took pains to say that while they were showing Humble properties and methods that the operations are typical. In this way the two companies made an investment in good public relations not only for themselves but also for the industry as a whole.

Upper Right: At the Hughes Tool Company factory at Houston the newsmen watch rock bits being tested on blocks of granite.

Lower Right: Halliburton Oil Well Cementing Company demonstration at a Humble well on the King ranch in Southwest Texas.

POST-WAR DEVELOPMENT PROGRESSING IN HOLLAND'S COEVORDEN FIELD

SHOWINGS of oil were found in Holland as long ago as 1923 when traces were brought to light in connection with the pulling of casing from a shaft that had been sunk in an effort to locate coal measures at Winterswijk near the eastern border. Apparently the incident aroused little general interest but shortly after 1930 attention was directed to the possible presence of oil in the eastern provinces by the active exploration conducted by the Germans on their side of the border which resulted in bringing in several small producing wells.

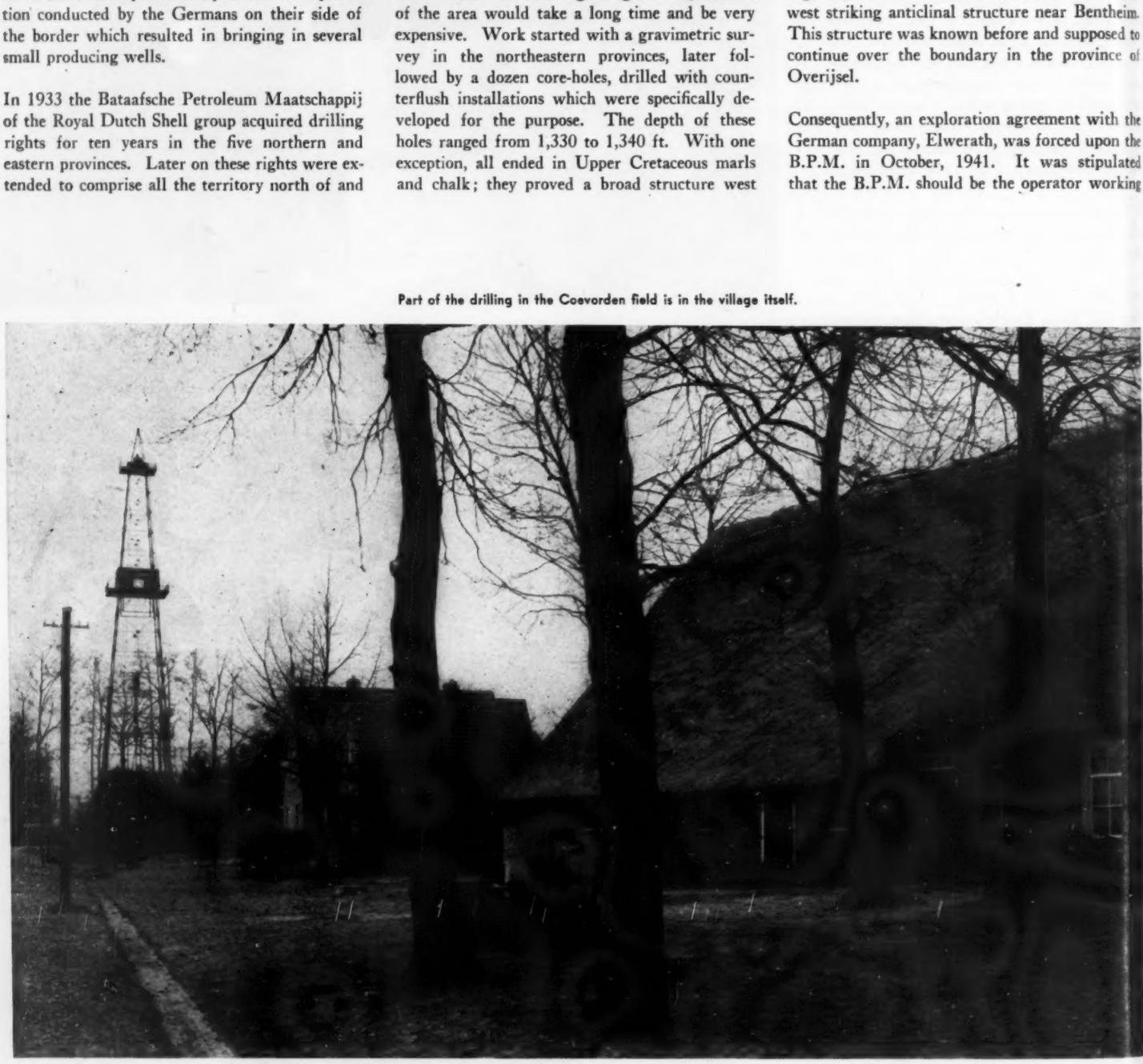
In 1933 the Bataafsche Petroleum Maatschappij of the Royal Dutch Shell group acquired drilling rights for ten years in the five northern and eastern provinces. Later on these rights were extended to comprise all the territory north of and between the great rivers. These rights were to terminate in 1953, with provisions for prolongations under certain circumstances.

No surface indications of geologic structure were available nor, with the exception of a few boreholes in the easternmost parts of Gelderland and Overijsel, were data on the subsurface to hand. It was clear from the beginning that exploration of the area would take a long time and be very expensive. Work started with a gravimetric survey in the northeastern provinces, later followed by a dozen core-holes, drilled with counterflush installations which were specifically developed for the purpose. The depth of these holes ranged from 1,330 to 1,340 ft. With one exception, all ended in Upper Cretaceous marls and chalk; they proved a broad structure west of the little town of Coevorden, in the southern part of Drente. No oil traces were encountered and, with the outbreak of the war, in September 1939, all activities came to a halt.

Soon after the invasion, the Germans showed much interest in oil possibilities along the eastern border. In October, 1939, they had discovered a gas field in the Permian Zechstein on an east-west striking anticlinal structure near Bentheim. This structure was known before and supposed to continue over the boundary in the province of Overijsel.

Consequently, an exploration agreement with the German company, Elwerath, was forced upon the B.P.M. in October, 1941. It was stipulated that the B.P.M. should be the operator working

Part of the drilling in the Coevorden field is in the village itself.



with Netherlands personnel, while all the materials not available in the Netherlands were to be supplied by the Germans.

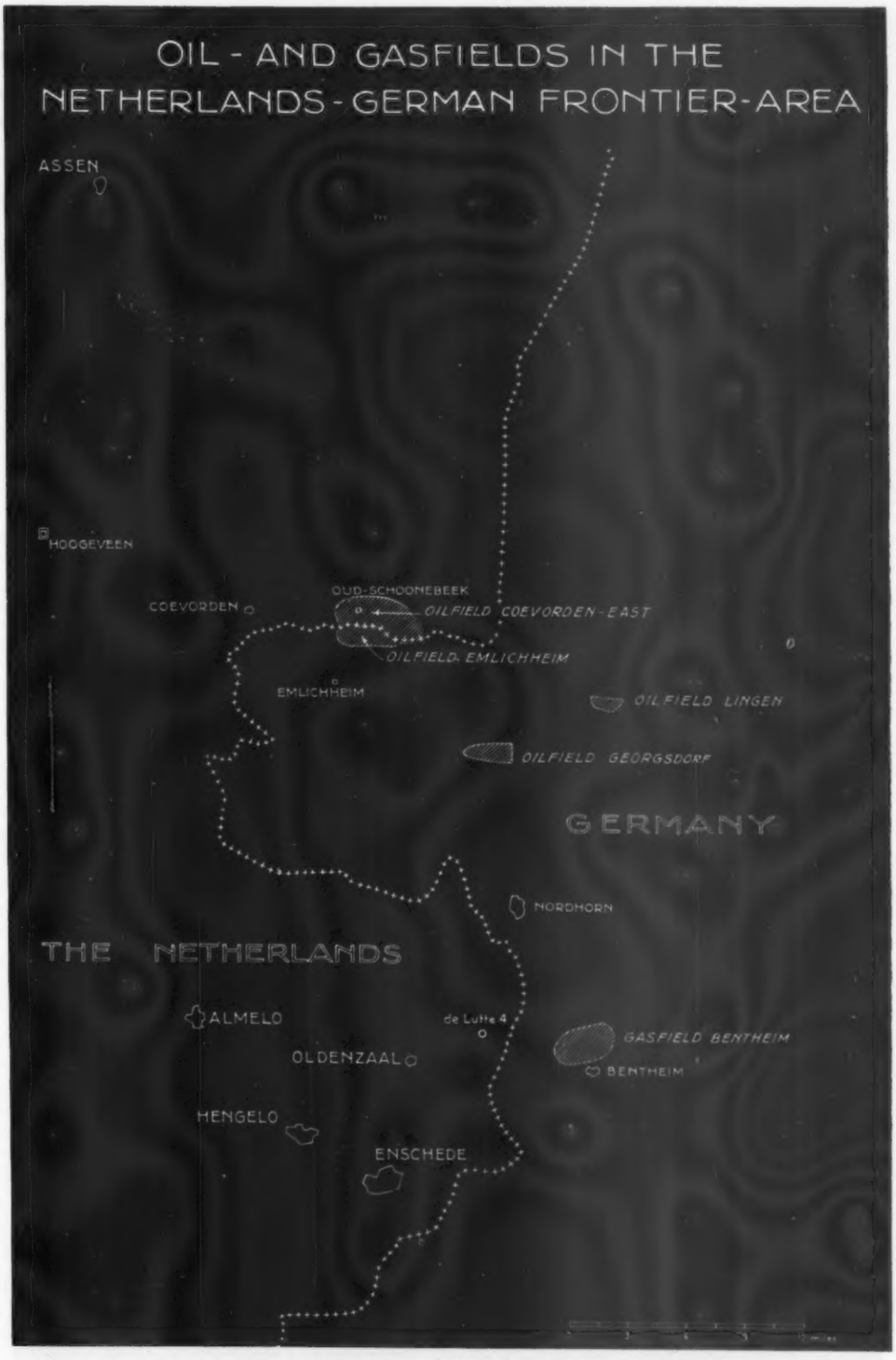
The gravimetric survey was now extended over the whole area of the exploration permit. Seismic refraction work followed, and over the structures in the Eastern Netherlands some dip-shooting was done. Simultaneously, core-drilling was taken up again, first near the eastern border of Overijsel, but gradually spreading westward as far as Delft in the province of South Holland.

The first well, C.1, intended to explore oil possibilities directly, was located west of Coevorden. In Northwestern Germany oil sands sometimes occur in the Lower Cretaceous and in the Upper Jurassic. However, in this first well both proved absent. The next lower prospect is the Zechstein, but the depth was too great to be within reach of the outfit used.

In the meantime the Germans had discovered by geophysical methods that the structure already known west of Coevorden runs farther east, forming a broad culmination near the little village of Oud-Schoonebeek; it crosses the boundary at the southeastern extremity of Drente. Accordingly, the outfit was moved to a site five miles to the east of Coevorden, and started drilling C.2 in November, 1942. In February 1943, a thin oil layer in porous limestone of Portland age was cored at a depth of 2,900 ft. Drilling continued to 4,172 ft. in Liassic. In July the well was put on the beam and produced seven barrels of a heavy, very viscous oil. This was the first regular production of crude oil on the Coevorden structure as well as in the Netherlands, but its economic importance was negligible. With normal prices it would hardly be worthwhile to pump the well, let alone to drill for it. The product was used as fuel.

Thereupon it was decided to investigate the structure further by drilling well C.3, located 7,000 ft. to the east of C.2 on what was supposed to be the north flank. However, before the outfit had been completely installed, the Germans succeeded in completing a well near the village of Emlichheim, about 1,000 ft. south of the boundary, which runs east-west at this point. E. 1, was reported in August 1943 to produce about 240 bbls, of heavy oil from 100 ft. of sand, topped at about 2,560 ft. depth. The Germans insisted upon rapid exploitation on the Netherlands side of the boundary near the Emlishheim well, but finally it was decided to await the results of C.3.

This well started drilling in September 1943, and in November found (at a depth of 2,630 ft.) a fine, very loose, oil-saturated sand in the Lower Cretaceous (Valanginian); with a thickness of about 90 ft. Since well C.3 was located about 6,330 ft. north of E.1 across the general trend of the structure, an oil field of not too small dimensions, but with small production per well and an inferior quality of crude, was indicated.



Well C.3 was drilled deeper to 3,652 ft. in Liassic and finally brought into more or less regular production in July, 1944. The oil had just enough pressure to flow over, but production was kept down to 120 bbls. per day by September this had dwindled to about 15 bbls. per day. It was later found that the bottom hole had sanded up and the tubing was clogged wtih paraffin wax.

A new well, C.4, was started 1,300 ft. farther north on the flank, but it was not completed until the middle of 1945, after the German surrender. The Germans had by that time completed about seven wells on their side of the boundary, but with the military collapse activities were suspended.

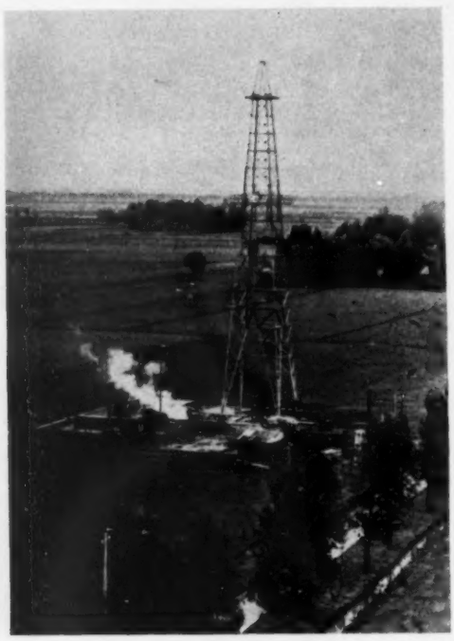
After the liberation of the Netherlands drilling was resumed, but owing to the scarcity of materials such as casing, tubing and pumping installations, as well as to the old-fashioned German drilling machinery, progress was comparatively

slow. By May 1946, eight wells were completed as producers and two were failures on account of adverse geological conditions.

The geological formations are as follows:

	Thickness in feet
Quaternary and Tertiary sands, clays, gravel	1,200-1,550
Unconformity	
Cretaceous;	
Turonian, Cenomanian and Albian; marls and chalk	1,100-1,450
Unconformity	
Hauterivian and Valanginian; sands and shales	150
Wealden; shales and limestone stringers	360
Jurassic:	
Portland; claystone, oölitic limestone	500
Unconformity	
Liassic; dark grey to black claystone	

Well C4 as viewed from the derrick on C6.



As a whole the dips are very flat. Faults are apparently numerous and in this field troublesome, because displacements in opposing directions seem to have taken place. As a consequence, the thickness of the Upper Cretaceous shows great variations.

The limits of the field have not yet been found, except to the west. The zone where the oil sand wedges out under the Albian transgression has recently been ascertained by a dry hole.

Three drilling outfits of German make are in operation. It is hoped that these can soon be replaced by installations of American type which will allow of faster drilling and, especially of shorter rigging-up time. The casing scheme is 9⅝ in. conductor to about 650 ft, 6⅝ in. cemented above the oil sand, and 4¾ in. slotted pipe as liner. The slots are 0.02 in. wide.

The crude oil has a high pour point, is very viscous, paraffinic, and contains small percentages of kerosene and gas oil. The gravity is 25 degrees A.P.I. Transportation offers technical difficulties owing to the high pour point, especially in winter time. The gas content is very low.

The six wells in regular production in May, yielded a daily total of 760 bbls. They have not yet all been provided with pumps. The discovery well C.2 is closed in, because the daily recovery was too low and the pumping outfit could be used elsewhere to better advantage.

Normally the wells are provided with a 2½ in. liner pump, 2½ in. tubing and ¾ in. sucker rods. Each well has a pumping jack, driven by an eccentric motor. In future the wells will be combined to groups of seven or eight, with common test tanks, pipe line pumps and boilers; the last-named being used also for heating purposes. Well-pulling equipment is on order; its lack is severely felt in connection wtih paraffin wax and sanding-up troubles.

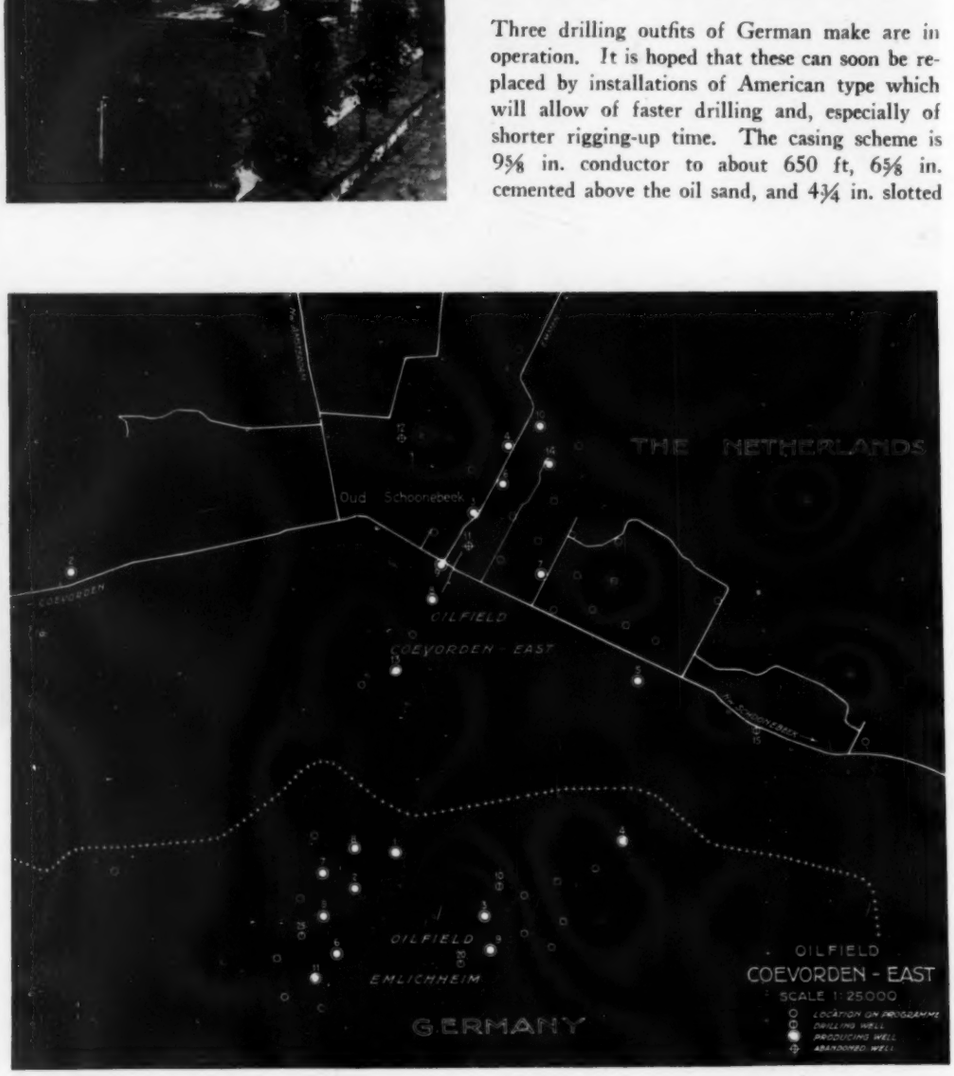
The total production of that part of the field which is within the Netherlands boundaries has been as follows in barrels:

1943	1,460
1944	12,240
1945	40,750
1946 (4 months)	56,680

The crude is being sent to Pernis Refinery for cracking.

The production of the German part has been reported to be around 350 bbls. per day. It is low on account of sand trouble caused by too wide slots in the liners.

The first impulse for the Germans to explore in the Netherlands lay in the expectation of extending the Bentheim gas field further westward over the boundary. After a few holes had been drilled for geological reconnaissance, a location for a deep test was chosen near the hamlet de Lutte, five miles north-east of Oldenzaal. Drilling started in January, 1944, but as a result of the events of September it was stopped till July, 1945. After passing through a salt bed of the Upper Bunter Sandstone, the well encountered fishing trouble, but finally passed the lost tools and on May 1, 1946, was over 4,200 ft deep. The formation is very hard standstone and shale; the rock bits are of poor quality. Fishing for broken tools is almost a daily routine and progress is extraordinarily slow. So far only doubtful traces of gas have been encountered, but it is hoped to reach the prospective Plattendolomite (Zechstein) as a worth-while quantity of gas here would be most welcome to the Netherlands industry, to relieve the very pressing fuel situation.



The above data, maps and photographs are published through the courtesy of the *Shell Magazine*.

IDLE ISOMERIZATION UNIT CONVERTED TO PRODUCE POLYMER GASOLINE

By W. R. NEWMAN*

SUCCESSFUL conversion of a wartime butane isomerization unit to a non-selective catalytic polymerization unit has been accomplished by Frontier Refining Company of Cheyenne, Wyo. The cost was about $14,000. It was found necessary to install only one piece of new equipment to effect the changeover, which was engineered by Universal Oil Products Company. The job was done in about three weeks by the regular refinery force.

The converted unit has been operating for more than three months, producing 150-200 barrels per day of 10# R.V.P. motor polymer, increasing the total gasoline production of the refinery by 5 to 7 percent and effecting substantial savings in the amount of tetraethyl lead needed to bring the regular and premium grades of Frontier gasoline to the required octane rating.

The No. 2 refinery in which the conversion was made is an aviation gasoline plant built in 1943 for the Defense Plant Corporation. It consists of a crude unit of 3200 barrel per day capacity, a thermal reforming unit, a fluid catalytic cracking unit with design capacity of 2600 barrels per day (the smallest commercial unit in the world), a gas concentration system, a U.O.P. hydrogen fluoride alkylation unit, a U.O.P. isomerization unit and treating plant.

When the aviation gasoline refinery was built, it was interconnected by pipelines to No. 1 refinery, about 500 yards away, to permit interchange of raw materials and products. No. 1 plant, which was built in 1941, consists of a topping unit with charging capacity of 4500 barrels per day, a U.O.P. thermal cracker, capacity 700 barrels per day, an asphalt unit and lube oil blending facilities. It operates on Elk Basin (Wyoming) crude, a black oil of 28 A.P.I. gravity and containing about 2.3 percent sulfur.

Having in the two refineries all the equipment needed to make the various components of 100-octane gasoline, Frontier was a consistent producer of finished fighting aviation motor fuel until the nation's need for this special product ceased.

As operated during the war, gas oil from the topping unit in Refinery No. 1 was piped to the government-owned plant, where it was added to the gas oil produced in the topping unit of Refinery No. 2 and fed to the catalytic cracking unit. The cracked gases from the thermal cracking unit were fed into the gas concentration unit

W. R. Newman, vice president in charge of refining, The Frontier Refining Company, Cheyenne, Wyo.

with the liquid and gas products from the catalytic cracker, for the purpose of recovering light hydrocarbon fractions to be used as feed for the alkylation unit.

When the war ended, Frontier, like other refiners, was eager to convert as speedily as possible to the manufacture of products it could make to the best advantage for civilian markets. Therefore, it was decided to continue and increase the production of higher grade motor gasoline and at the same time to develop a market for bottled gas which would offer an outlet for the C_3-C_4 fractions.

With these objectives in mind, the company leased the facilities of Refinery No. 2 from the government. Of these facilities it was intended at first to operate only the fluid catalytic cracking unit and the gas concentration unit, the former to make cracked gasoline of superior quality and the latter to stabilize the gasoline and to recover the maximum of C_3-C_4 for bottled gas. The Frontier management asked Universal to make a study of the gas concentration system with a view to simplifying it and reducing operating costs and to consider the entire refinery picture as well.

The study disclosed two things: First, that the cost of operating the existing gas concentration system was very little greater than the cost of operating a simple absorber-stabilizer system, and it had the advantage of recovering the maximum of light hydrocarbons. Second, that because of the growing market for gasoline and acceptance of the Frontier product, the light fractions could be converted to polymer gasoline more advantageously than they could be marketed as bottled gas.

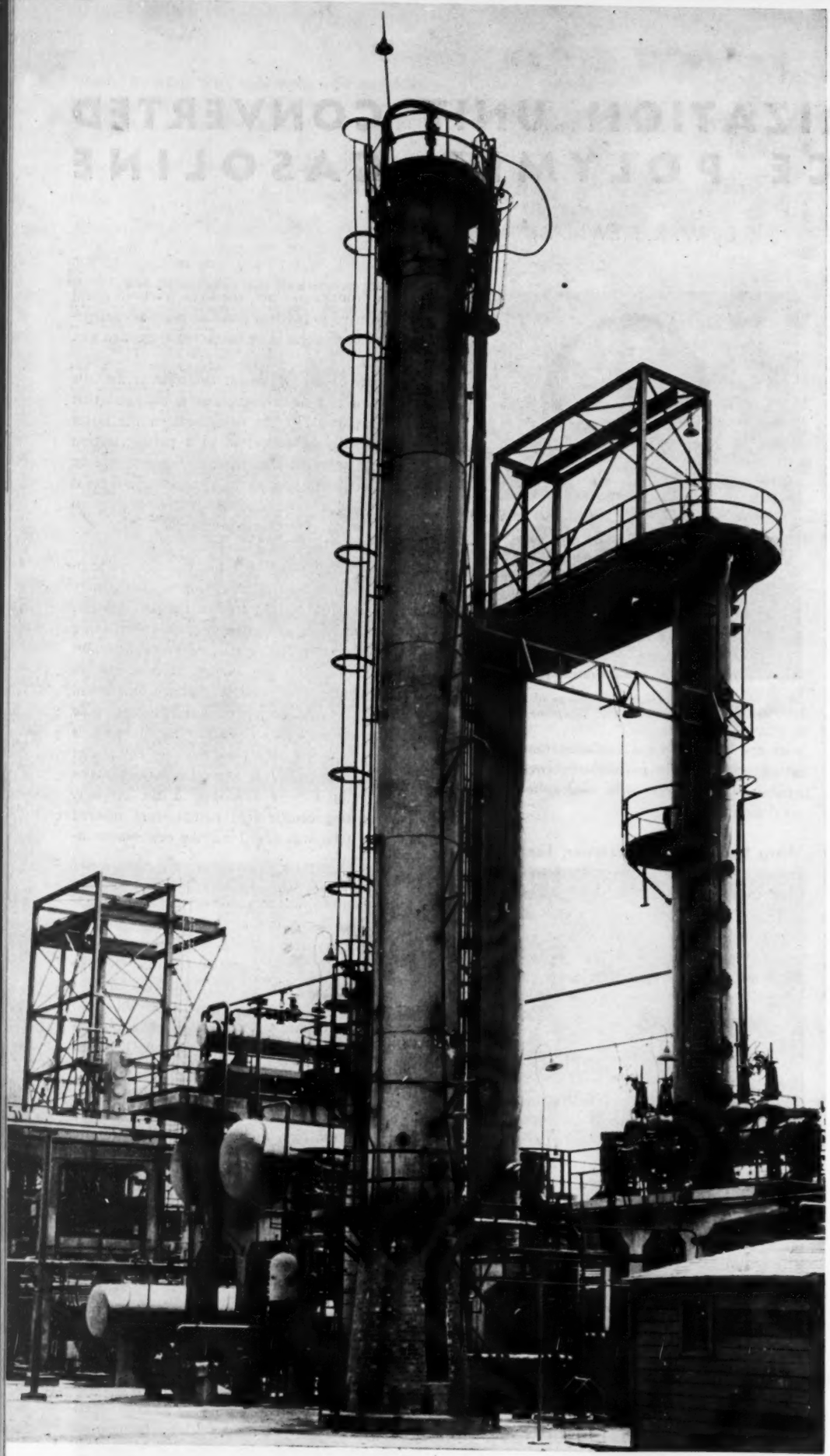
A review of the equipment available at the idle alkylation and isomerization units disclosed that a large portion of the equipment in the latter could readily be converted to a polymerization unit. It appeared that the conversion would be simple, requiring few piping changes or additions of equipment. The accompanying flow diagram shows the changes that were made.

The additional equipment specified for the conversion consisted of three G-fins to afford more surface for heating the feed to the poly reactor, two water-injection pumps for the maintaining of proper catalyst hydration, and a new filter pot for collecting the small amount of catalyst fines liberated when new catalyst is placed on stream. Actually, the filter pot, a vessel of 24 inches inside diameter, 5 feet high and suitable for 500 pounds pressure, was the only piece of new equipment that had to be installed. The other miscellaneous items required were available in the refinery. Two existing caustic feed pumps were rebored and new trim was added for the new water injection service.

Conversion of the reactor tower of the isomerization unit to serve as the catalyst tower for the polymerization unit was a simple matter, requiring only the fitting of a grating in order to make it possible to separate the polymerization catalyst into two 7-foot beds. Connections were added to the tower to permit introduction of a quench stream and water injection between catalyst beds. Four thermocouples were installed for the purpose of measuring catalyst temperatures.

Because of the high sulfur content of the crude processed at Frontier, the light fractions produced in cracking the topped crude and gas oil are high in hydrogen sulfide and mercaptans. Consequently, it becomes necessary to remove the sulfur compounds from the poly plant feed as they would otherwise become concentrated in the polymer, thereby reducing its blending value.

The sulfur content of the C_3-C_4 fraction when operating the gas concentration unit for maximum recovery of propylene and butylenes was known to be of the order of 1500 grams of combined H_2S and mercaptans per 100 cubic feet. This sulfur content can be held down to approximately 100 grams per 100 cubic feet by operating the deethanizer and other columns under



Former isomerization reactor, the lower portion of which now contains solid phosphoric acid catalyst for polymerization.

conditions that give less than maximum recovery of propylene.

The use of a regenerative type H_2S removal system was given consideration as a means for obtaining removal of a major portion of the sulfur compounds from the poly plant feed. However, making provision for such facilities would have delayed the start-up of the poly unit and would have increased the cost of making the conversion. It was decided therefore to start the operation in such a manner that the gas concentration unit would reject the bulk of the H_2S and mercaptans from the only plant feed, postponing the installation of a regenerative type H_2S removal system.

Following is a general summary of the manner in which the gas produced in the catalytic cracker is handled through the gas concentration and polymerization units.

The cracked gasoline and gases from the catalytic cracking unit are fed into the gasoline stripper of the gas concentration system, the bottoms from which is used as absorption oil in the deethanizer into which passes the gaseous and liquid overhead from the gasoline stripper. The deethanizer now, as before, is operated to remove all gases lighter than the propane-propylene fraction.

The deethanizer bottoms stream is sent to the former depentanizer which now acts as a debutanizer to separate the C_3-C_4 fraction from the catalytically cracked gasoline. A low vapor pressure gasoline is produced as bottoms from this column in order to recover all possible of the C_4 fraction for polymerization plant feed.

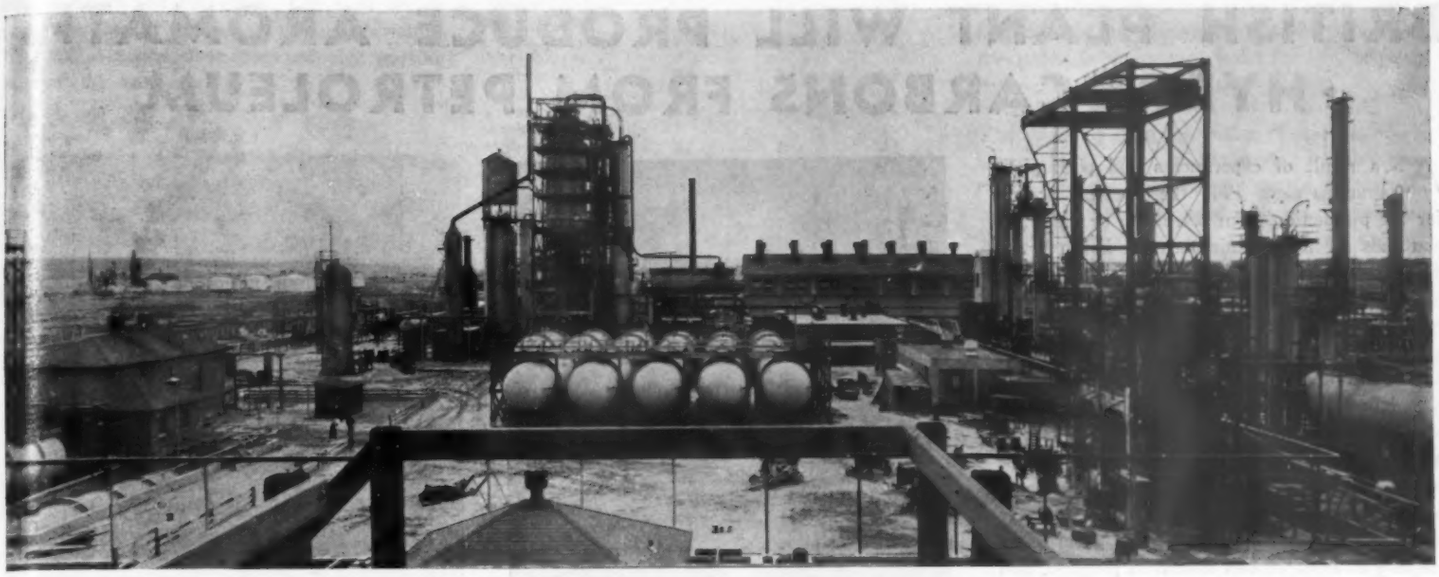
The liquid C_3-C_4 fraction obtained as a net overhead stream from the gas concentration unit depentanizer is pumped through a caustic wash on its way to the polymerization unit for the removal of H_2S and mercaptans. Thus is produced a low sulfur polymer having optimum blending octane number.

The fresh C_3-C_4 feed is collected in a combined feed surge drum where it is mixed with a low olefin content recycle stream from the polymer stabilizer overhead. The recycle stream is used to dilute the olefin content of the feed to the catalyst tower so that the temperature rise occurring in the catalyst beds, as a result of the

Table 1

Fractional Distillation Analyses of Feed and Products at the Polymerization Unit

	Fresh Feed Mol. %	Recycle Mol. %	Polymer Liq. Vol. %
Propylene	15.7	0.5	
Propane	14.1	36.3	
Isobutane	21.8	46.7	10.4
Butylenes	36.2	2.2	2.4
Normal butane	12.2	14.3	11.9
Isopentane	0	0	1.0
Normal pentane			1.8
Hexane +			72.5
Specific gravity			0.7015
Olefin content	51.9	2.7	
R.V.P.			23.3
E.P.			417° F



General view of 100-octane gasoline plant as built during the war.

exothermic polymerization reaction, will not be excessive. Typical analyses of the fresh feed and recycle are shown in Table 1.

The fresh feed normally contains 45-50% C_3 and C_4 olefins. Sufficient recycle is used to obtain a combined feed having an olefin content of approximately 20-22%.

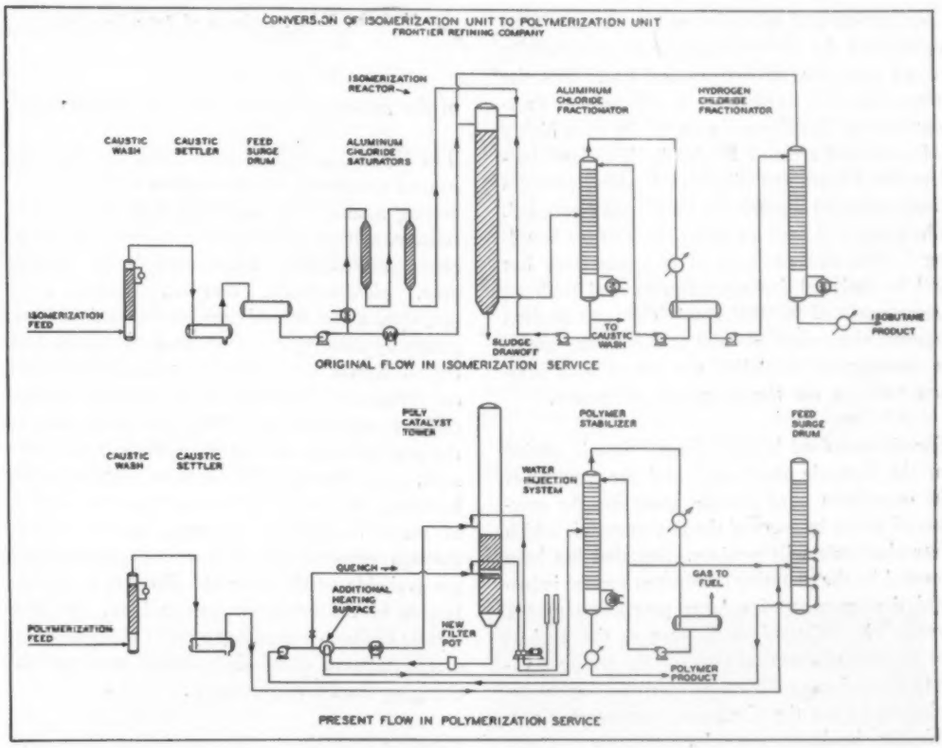
The combined feed is then pumped through an exchanger to recover the heat from the catalyst tower effluent, through a preheater, and then into the catalyst tower. The temperature of the feed to the catalyst tower is controlled to give the desired degree of olefin conversion without exceeding a maximum of 450°F. at any point in the catalyst beds.

Under normal operating conditions when processing a 20% olefin content combined feed the temperature in the catalyst beds will range from 350-380°F. inlet to 430-450°F. outlet.

The conversion of olefins obtained at these temperatures has been of the order of 90-95%.

Effluent from the catalyst tower is fed to the column which was formerly used for aluminum chloride recovery in the isomerization process but is now used as a polymer stabilizer. The net overhead from this stabilizer is released to the fuel system. The condensable portion of the polymer stabilizer overhead stream is used for reflux as well as recycle.

The bottom fraction from the polymer stabilizer is high vapor pressure polymer which is blended directly with the catalytically cracked gasoline. Sufficient butanes are retained in the polymer to control the vapor pressure of the total gasoline make of No. 2 refinery.



Thus, the Frontier polymerization unit is producing on an average of 150 to 200 barrels daily of 10# Reid vapor pressure polymer gasoline having an ASTM octane rating of 81-83 and a research octane rating of 95-97.

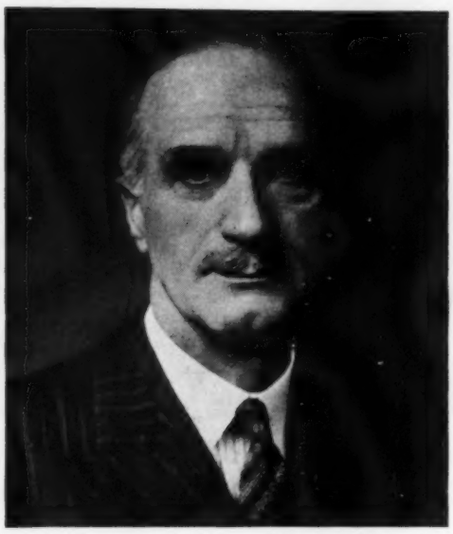
Building Chemical Plant

Ethylene glycol and ethylene oxide are among the initial products which will be manufactured by Jefferson Chemical Company, Inc., at Port Neches, Texas. Jefferson Chemical was organized in November, 1944 by The Texas Company and American Cyanamid Company to produce chemicals from petroleum and petroleum gases.

Construction of Jefferson's first plant is being handled by Lummus Company and by E. B. Badger and Sons Company. Upon completion this plant will use as raw materials petroleum gases obtained from the nearby Port Arthur refinery of The Texas Company. Actual production is expected to begin during the summer of 1947.

BRITISH PLANT WILL PRODUCE AROMATIC HYDROCARBONS FROM PETROLEUM

AS a result of experiments and pilot plant operations since 1941 the Catarole process for the production from petroleum of basic raw materials for the organic chemical industry was developed in Great Britain by Dr. Ch. Weizmann and his associates. In 1945 a company called Petrocarbon, Ltd., was organized to acquire exclusive rights under Dr. Weizmann's patents to operate the process in the United Kingdom and a number of European and overseas countries. Late in September this year it was announced that under agreement with the company capital of nearly £2,000,000 was being provided by Finance Corporation for Industry Ltd., an organization formed under government auspices to assist British industrial progress, and by a group of London banking firms, to construct a large commercial plant to operate the process on a full industrial scale.



H. Stuart Ebbon, chairman of Petro-Chemicals.

R. Ashton Hamlyn, chairman of Petrocarbon, Ltd.

Construction and operation of the plant will be undertaken by Petrochemicals Ltd., a wholly owned subsidiary of Petrocarbon Ltd. The site selected for it is a tract of over 700 acres at Partington near Manchester in one of the most highly industrialized areas of England. The land borders the Manchester ship canal which provides direct access to ocean going vessels via Liverpool. The plant will have an initial capacity for handling 50,000 tons per year of charging stock but will be designed for expansion to deal with an annual input of 100,000 tons. The most modern features of construction and heat economy are to be incorporated including the use of back pressure turbines for the generation of power.

The site acquired is much larger than is needed for the Caterole plant alone and the purpose of the organizers is to provide space for the erection of plants by users of the raw materials which Petrochemicals will produce. Sanction has been granted by the planning authorities for the industrial development of a large proportion of the area. Thus Caterole will serve as the nucleus for a group of chemical factories producing a variety of products. This is considered a logical development since the Caterole process makes possible the simultaneous production from an essentially non-aromatic charging stock, such as naphtha or gas oil, of the whole range of the aromatic hydrocarbons in substantially pure form and of a gas mixture containing a high proportion of olefines.

Raw materials of the Caterole process are primarily naphtha and gas oil, both of which are in abundant world supply and can either be imported or produced by refineries within the country. Other starting materials, such as shale oil or oil from the low temperature carbonization of coal, may be used however. The chemicals, solvents and spare parts required for the operation of the process all can be obtained domestically.

The liquid reaction product from the Caterole process contains a broad range of high and low-boiling aromatic hydrocarbons such as benzene, toluene, xylenes, ethylbenzene, styrene, alkyl-benzenes, naphthalene, alky-naphthalenes, anthracene, phenanthrene, fluorene, pyrene and chrysene, all of which may be obtained in pure grades by azeotropic or fractional distillation and crystallization, with only slight additional chemical treatment. Syntheses using aromatic hydrocarbons and olefines as starting materials, such as the production of styrene from ethylene and benzene, or of isoproply-benzene from propylene and benzene, which have become an important feature of modern chemical industry, can be carried through economically because both components are available on the same site. Another favorable feature of the process is its flexibility. Within certain limits it is possible to vary the proportions of the different chemicals produced so as to suit changing market requirements.

Products from the process are used in the manufacture by a variety of commodities, such as paints and varnishes, dye-stuffs, pharmaceutical products, photographic chemicals, synthetic fibres, synthetic rubbers, solvents, plastics, plasticisers, cosmetics and insecticides. Some of the products have uses either as solvents, heat media or blending stock for engine fuel. The need for expanding home production of these materials has been recognized by the Hydrocarbon Oil Duties Committee and has been repeatedly stated by a number of leading consumers during recent years.

Coal tar products have been the chief basis of the British chemical industry but during the past ten years it has become evident that coal is no longer the only, nor necessarily the main, source of aromatic chemicals and that it is possible to transform aliphatic hydrocarbons into aromatics of the same carbon number with the aid of catalysts such as alumina and promoters such as chromium oxide. Moreover, the extent to which coal tar can be produced depends on the extent to which the coke, forming the main product of the process, can be commercially utilized.

Further research into the conversion of aliphatic hydrocarbons into aromatics has shown that it is possible to treat any non-aromatic charging stock in such a manner that the whole range of aromatic hydrocarbons is obtained. Petroleum is, therefore, no longer second to coal as a source of aromatic hydrocarbons. The choice of special charging stocks and of the processing conditions makes it possible to vary the quantitative composition of the resulting aromatized product.

If petroleum is passed through a packed tube at atmospheric pressure at 630-680°C and a velocity of 0,05-0,5 litres per hour and litre catalyst volume, the resultant liquid has an aromaticity of at least 95 percent. In addition, value gaseous products are formed.
The use of metals, such as copper, as packing materials reduces the temperature required for substantial aromatization to 630-680°C, and minimizes the extent to which carbon formation takes place. These two factors, combined with the purity of the products make the process economical.

Table I lists the products obtained by aromatization of a naphthenic heavy naphtha, both the

liquids, solids and the gases. The high degree of unsaturation of the gaseous products is noticeable, and it makes these gases valuable starting materials for synthesis.

TABLE I

Aromatization of a Naphthenic Heavy Naphtha

Charge	
Specific Gravity	0.793
Boiling Range (5-95%)	102.228°C
Process Temperature	680°C
Space Velocity	0.24
Liquid Product	
Recovery, % by weight of charge	About 50%
Specific Gravity	0.870
Composition, in % by weight of charge	
Boiling below benzene	1.8
Benzene	11.8
Toluene	10.7
Xylenes, Ethylbenzene, Styrene	6.8
Alkylbenzenes (150-180°C)	3.4
Above 180°C (Polycyclics)	15.4
Gaseous Product	
Composition in % by weight of charge	
Hydrogen	0.3
Methane	20.1
Ethane	6.7
Ethylene	7.8
Propane	1.8
Propylene	8.7
Butanes	1.3
Butenes and Butadiene	3.4

The proportion of gaseous to liquid products can be varied to a considerable degree by selection of appropriate charging stocks. In general, the more paraffinic a charging stock the greater the proportion of gaseous products and the more naphthenic or aromatic a charging stock the greater the proportion of liquid products. This is reflected by the experimental result that, for fractions of different chemical composition but of the same boiling range, there is a rough proportionality between the density of the charging stock and the yield of liquid products.

Another way of increasing the proportion of liquid products is to use higher boiling charging stocks. Generally, the rule holds that the higher boiling the charging stock, the greater the proportion of liquid products. These general considerations are borne out by typical analyses given below, of the cracking products from (a) a naphthenic naptha of Texas origin, (b) a paraffinc naphtha of Iranian origin, and (c) a paraffinic kerosene of Iranian origin:

TABLE II

Yields From Texas and Iranian Stocks

Boiling Range (Engler)	Naphthenic Texas Naphtha	Paraffinic Iranian Naphtha	Paraffinic Iranian Kerosene
5%-95%	95-°205°C	113°-183°C	175°-261°C
Density 20°C	0.799	0.756	0.796
Yields in percent by weight calculated on total products. (Processing losses Approx. 1%)			
Gaseous Products			
Hydrogen	0.5	0.9	0.5
Methane	18.3	24.0	13.7
Ethylene	7.4	11.6	11.6
Ethane	6.5	9.6	7.4
Propylene	9.0	10.6	10.9
Propane	1.9	1.3	1.4
Butylene	4.8	4.5	3.9
Butane	1.3	0.8	0.5
Total gases	50	63	50
LIQUID PRODUCTS			
Below Benzene	1.1	0.4	1.0
Benzene Fraction	11.0	6.1	7.5
Toluene Fraction	11.0	6.5	7.5
Xylene Fraction	6.0	5.1	5.8
Alkyl Bezene Fraction	2.6	4.5	9.4
Naphthalene Fraction	3.5	2.5	3.7
Alkyl Naphthalene Fraction	4.0	2.7	3.8
Anthracene Fraction	2.7	2.6	2.3
Chrysene Fraction	2.4	2.6	1.6
Pitch (Residue)	6.0	4.0	7.5
Total Liquid Products	50	37	50
	Naphtha Texas	**Naphtha Iranian**	**Kerosene Iranian**
Refined Naphthalene	2.3	1.2	1.7
Anthracene	0.2	0.1	0.15
Phenanthrene (80%)	0.5	0.3	0.4
Chrysene	0.3	0.2	0.2
Pyrene	0.2	0.1	0.15

It appears appropriate to comment on the composition of the polycyclic fraction of the reaction product, as the process has succeeded for the first time in converting petroleum into the whole range of such substances. They are of interest to the manufacturers of dyestuffs, pharmaceuticals and other organic chemicals.

The following list names some of the constituents of this polycyclic fraction:

naphthalene	phenanthrene
α-methyl-naphthalene	anthracene
β-methyl-naphthalene	1-methyl-anthracene
1.6-dimethyl-naphthalene	2-methyl-anthracene
2.6-dimethyl-naphthalene	2.7-dimethyl-anthracene
1.2-dimethyl-naphthalene	1.2-benzanthracene
1.7-dimethyl-naphthalene	1.2-benzfluorene
1.2.5-trimethyl-naphthalene	2.3-benzfluorene
1.2.6-trimethyl-naphthalene	chrysene
fluorene	pyrene
acenaphthene	3.4-benzpyrene
biphenyl	1.2.7.8-dibenzo-chrysene

It will be noted that the only side-chain appearing in these substances is the methyl group. This, undoubtedly, is due to the fact that longer side-chains are broken off in form of the corresponding olefines at the process temperature. In the "alkyl-benzenes" fractions, too, polymethylated benzenes predominate. They are, however, accompanied by substances in which the unsaturated nature of the side-chains increases the stability of the molecule (resonance stabilization), such as styrene, B-methyl-styrene and indene.

The relatively high percentage of styrene, ethylbenzene and pyrene is interesting; it is believed that this fact will shed some light on the reaction mechanism. The gases, as already pointed out, are highly unsaturated. All the syntheses starting from these olefines (glycol and glycol derivatives, isopropyl alcohol, acetone, etc.) become thus possible.

The industrial success of the whole process depends to a large extent on the proper utilization of the olefinic gases.

The board of Petrocarbon Ltd. consists of R. Ashton Hamlyn, chairman; R. E. F. de Trafford, T. L. McC. Lonsdale, F. Kind, managing director, G. Tugendhat, managing director, Lt. Gen. Sir W. G. Lindsell, and M. A. Colefax.

The board of Petrochemicals consists of H. Stuart Ebben, chairman, Lt. Col. Reginald Lindsay Benson, Dr. F. Kind, managing director, Dr. G. Tugendhat, managing director, Lt. Gen. Sir W. G. Lindsell, and M. A. Colefax.

Dr. Franz Kind and Dr. G. Tugendhat for the last ten years have been largely engaged on the building up of the Manchester Oil Refinery group of companies, with which the Catarole project is closely connected.

Dr. Weizmann has agreed to act as head consultant to the undertaking and Dr. Ernst Bergmann, his co-worker, will be technical consultant. It is intended that the research and development program of both Petrocarbon Ltd. and Petrochemicals Ltd. will be on a considerable scale, and Dr. H. Steiner will be in control of these activities.

Dr. G. Tugendhat, joint managing director, Petrocarbon Ltd. and Petro-Chemicals.

Dr. F. Kind, joint managing director, Petrocarbon Ltd. and Petro-Chemicals.

PRESSURE MAINTENANCE PROJECTS ON

By E. G. DAHLGREN

PRESSURE maintenance and such secondary recovery measures as water flooding and pressure restoration through gas injection are gaining momentum in Oklahoma, particularly since the state legislature has set up means of organizing and carrying on such projects. Oklahoma newspapers, for example, have been telling of proposed pressure maintenance projects in the flush and relatively new oil fields such as West Edmond, Northeast Edmond, Pauls Valley, East Pauls Valley, South Moore, Apache, and West Cement-Medrano.

The view of secondary recovery advocates is that oil reservoirs of Oklahoma have been barely touched. Don T. Andrus of the Interstate Compact Commission said recently that Oklahoma can produce 20 billion barrels more oil by secondary recovery methods and only one tenth that much by ordinary production methods.

The West Edmond pressure maintenance project is the largest one in preparation with the West Edmond operators meeting periodically to iron out details in the program to return the gas, produced with the oil, to the Hunton Lime producing horizon to maintain the bottom hole pressure and to defer the time when artificial means will be necessary to lift the oil. The West Edmond operators are attempting to take advantage of the new unitization law, House Bill 339, which was passed by the Oklahoma Legislature in April, 1945. This law provides that, upon petition of lessees of 50% or more of the area sought to be unitized, the Oklahoma Corporation Commission will grant a hearing and order if the plan is found to be in the interest of conservation. If lessees owning 15% or more of the area embraced by the unit file written objection to the plan within a period of 60 days after the order is entered the unit will not be created.

Ever since the West Edmond field was discovered on April 30, 1943, production engineers have been recommending the installation of a gas injection pressure maintenance project to offset the bottom hole pressure decline and eliminate the production of excess gas. At the present time an excess of 150 million feet of gas, produced with oil production, is not being utilized and being vented to the atmosphere. Expenditures of $2,700,000 have been recently authorized for new construction and expansion of plant and pipe line facilities to increase the utilization of gas in the field. The Phillips Petroleum Company and the Continental Oil Company jointly owned natural gasoline plant in the Old Edmond field, three miles distant, will be expanded. At the present time the plant is selling transmission lines 30 to 35 million cubic feet per day. The new facilities will permit an increase of 20 million feet daily. The Peppers Refining Company has had orders placed for equipment to increase capacity of its West Edmond plant to around 35 million cubic feet of gas daily. The plant is now selling 10 to 12 million cubic feet daily. The Cities Service Gas Company expects to complete by November a 12-inch gas line from West Edmond to Drumright which will increase the capacity of gas facilities by 27 million cubic feet to 60 million cubic feet daily.

Reservoir engineers have estimated that the West Edmond field contains approximately 600 million barrels in place with an expected recovery of about 140 million barrels under present methods of production. As of July 1, 1946, the field had produced approximately 48,000,000 barrels. It is estimated that from 40 to 80 million barrels additional oil can be produced if 75% of the produced natural gas is returned to the reservoir. The recovery of 40 million barrels additional will justify the installation of a pressure maintenance plant. Assuming that the West Edmond project is approved, it will take about a year before the plant can be completed. The plant will cost about $5 millions. It is estimated that about 160 billion cubic feet of gas can be saved by shutting in the high gas-oil ratio wells and producing the field's allowable from 300 to 400 low ratio wells. The field now has approximately 750 producing oil wells on 40-acre spacing. In May the field produced 2,122,446 barrels. The prevailing gas-oil ratio in the field is maximum of 3,770 cubic feet of gas per barrel of oil.

Gas-oil ratio tests in the field were begun on August 5 with a schedule of eight tests a day. Tests are six hours in duration with other wells making water, pumping, flowing intermittently, or flowing by heads scheduled for 24 hour tests. Wells were required to be adjusted to flow at a 24-hour rate of between 124 barrels and 186 barrels per day.

The Harper-Turner Oil Company discovered the Northeast Edmond field in north-central Oklahoma County five years ago. The company, a partnership of Forrest Harper and Roy Turner, the Democratic nominee for Governor, is fortunate in owning all of the wells and most of the royalty in the field. A gas injection program has been outlined and an application is expected to be filed with the Oklahoma Corporation Commission for a unit operation order.

The West Cement-Medrano pool operators in Caddo County have been working to establish a pressure maintenance program under unit operation. Although 5.8% of the original stock tank oil and 58% of the original gas cap gas is already produced, the geological features and reservoir characteristics present many advantages for the beneficial application of an efficient gas injection program.

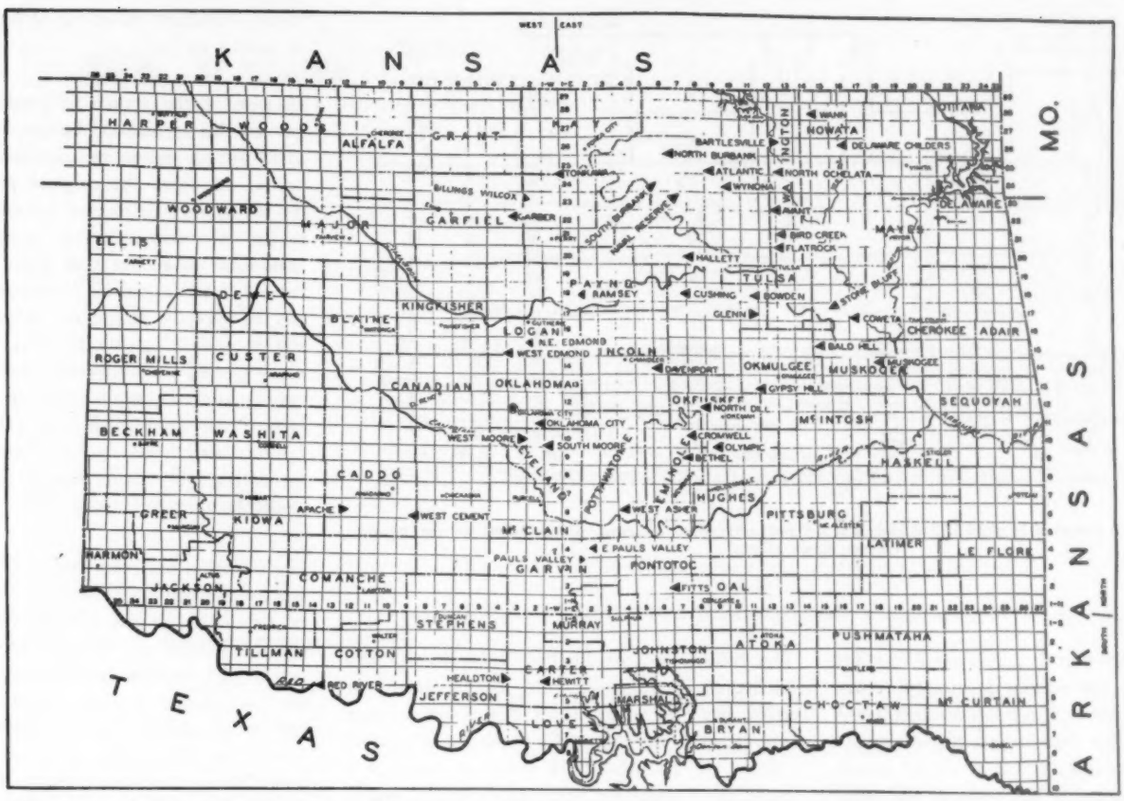
The West Cement-Medrano pool was discovered in October, 1936, when the Magnolia Petroleum Company drilled its Medrano No. 6 gas well in the SW ¼ of S. 36, T. 6N., R. 10W. It was assumed that a gas reservoir had been found. However, after many of the pool's 20 gas wells had been drilled and 30 billion cubic feet of gas produced, oil was discovered in March, 1943 when the Stephens Petroleum Company's Pierson No. 1 in the SE ¼ of Section 36. The gas pool was thus transformed into a gas cap of an oil reservoir with an estimated 96 million barrels of oil in place. Thirty-five commercial oil wells have been drilled on 40-acre spacing after the oil discovery. The gas well were drilled on 160-acre spacing. As of March 1, 1946, the total recovery was 5,600,000 barrels of oil and 60 billion cubic feet of gas.

The present production is limited to an allowable rate of 23,600,000 cubic feet of gas for the gas zone and 5,300 barrels per day for the oil zone with a top allowable of 200 barrels per day per well. The productive area of the Medrano sand covers 3,280 acres which is divided into 1,300 acres for the oil zone and 1,980 acres for the gas zone. The oil zone is approximately 2,000 feet in width and six miles long extending southeast and northwest. The gas cap extends the length of the oil zone and is widest, about one mile, near the center of the field.

Faults extending northeast and southwest divide the pool into five segments. Any engineering consideration of reservoir performance must recognize the possibility of intercommunication between these segments. The original reservoir pressure at 4,000 subsea, the gas-oil contact, was 2,000 pounds per square inch. On account of gas production at the time of oil discovery, the reservoir pressure varied from 1,142 to 2,000 pounds. The last general pressure survey in November, 1945, showed the pressures to vary from 880 to 1,500 pounds.

At the present time the reservoir volume of gas production is five times greater than the relative reservoir volume of gas to oil. At the production rate the gas cap would be depleted in less than seven years. If relative rates of production permitted an equivalent pressure decline for both oil and gas zones, production for the oil zone

S ON THE INCREASE IN OKLAHOMA



Map showing location of current and proposed pressure maintenance and other secondary recovery projects in Oklahoma.

by primary means would be similar to a dissolved gas reservoir with a productive life of about 28 years.

With gas injection at a rate of 60% of the produced gas, the ultimate oil recovery will be about 34,100,000 barrels or 10,500,000 barrels more than under present production methods.

The West-Cement-Medrano pool is ideal for gravity drainage which will accentuate additional recovery under a gas injection program. In order to obtain greater drainage efficiency under a gas injection program, several new wells should be drilled low on the flank of the structure to facilitate selective production of low gas-oil wells over high ratio wells. These wells should be drilled without regard to property lines and can be drilled only under joint operation. With joint operation gas volumes from oil wells would be easier to control as well as volumes handled by a compressor plant.

Estimated lifting costs during the life of a gas injection program would be approximately 15% less than for primary operations since greater efficiency in operations by pressure maintenance requires less expense than in primary operations.

Snowden Oil & Gas Company and Mass-Tex Oil & Gas Company are building a three stage compressor plant north of Cement in Caddo County to treat gas now being vented for distribution to transmission lines. Four 600 HP motors have been delivered. About 225,000 cubic feet of gas will be used daily for injection purposes. Snowden Oil & Gas Company operates 17 wells in the East Cement-Rowe Pool. These wells have an allowable of 200 barrels per day per well. The gas will be utilized in gas lifting seven wells.

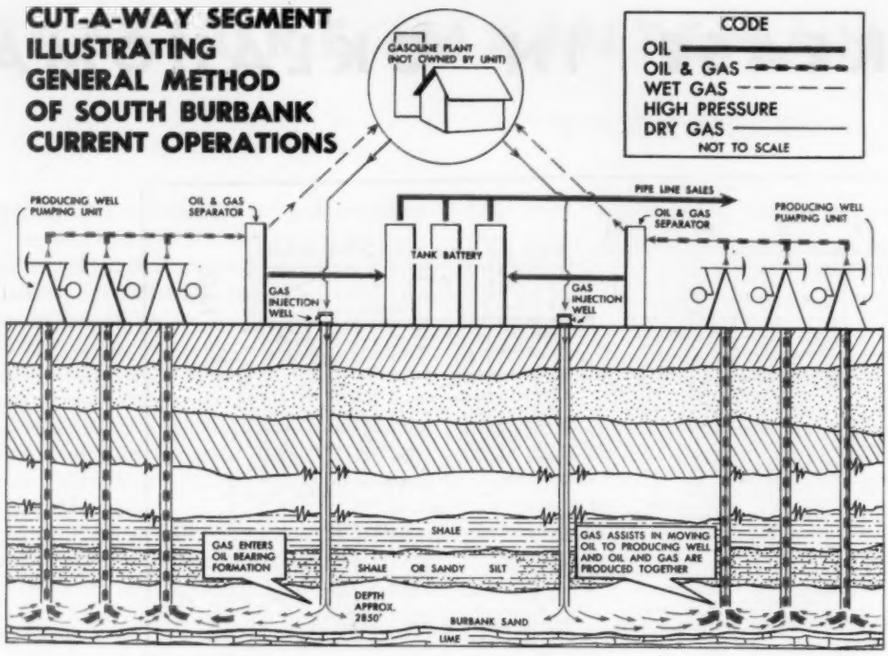
The Mid-Continent Petroleum Corporation in June was granted an order by the Oklahoma Corporation Commission permitting reinjection of gas into its Jury No. 3 well in the South Moore field in Cleveland County. The gas reinjection program is an experiment to aid in determining the feasibility of pressure maintenance in the South Moore field and West Moore fields. The Bartlesville sand horizon will be pressured with residue gas from a condensation type pressure station which will use about 3 to 6 million cubic feet per day of gas produced from the Bartlesville sand in the South Moore field.

Operators in the Apache pool in Caddo County are considering a pressure maintenance program to return gas produced with oil. The Texas Company is the largest operator with 18 wells. The Amerada Oil Corporation has 5 wells, Sinclair Prairie Oil Company 2 wells, and one each for Cities Service Company, Gulf Oil Corporation and Pure Oil Company. The wells are allowed to produce 175 barrels per day per well.

Plans for pressure maintenance in the Pauls Valley and East Pauls Valley fields in Garvin County are dormant for the time being. Operators have not been able to agree upon all details.

The South Burbank Pool in Osage County is one of the nation's outstanding examples of a successful unitized operation utilizing gas injection. Following the discovery of the field in 1934, the operators in June, 1935, unitized 2,760 acres of the 4,160 producing acres. Gas injection was started immediately and in 1941 the operation was changed to inject gas over the entire unit. The Carter Oil Company was the first operator of the unit with the Phillips Petroleum Company taking over the operation in 1940.

As of June 1, 1946, the South Burbank pool has



South Burbank pool is expected to yield 17,540 barrels of oil per acre after 29 years of operation on the general scheme shown above.

produced 28,500,000 barrels which are 7,350,000 barrels more than the estimated primary recovery. The pool is expected to produce 40,000,000 barrels or 87% more than under normal operations. Twenty acre spacing was instituted in the field which now contains 124 wells or one well to 18.8 acres. By deviating from the conventional 10 acre spacing, 104 wells were not drilled at a saving of an estimated $2,080,000. The producing wells were drilled systematically, using standardized equipment, and a total of about $2,320,000 was saved solely in production costs.

The North Burbank Pool, located one mile northwest, was discovered in 1920 and drilled up under typical oil boom conditions. A total of 2,200 wells were drilled on 22,700 acres. The gas energy was quickly dissipated under wide open flow operation. A repressuring program was started too late in 1926. The North Burbank Pool is expected to yield only 18.5% more than under primary operation. In the expected 45 years of operation the North Burbank Pool is expected to recover 10,900 barrels per acre, while the South Burbank Pool should recover 17,540 barrels per acre after only 29 years of operation.

The Ramsey Pool in Payne County was aided by gas injection for five and one half years to December 1945 when the gas injection program was discontinued to take advantage of the strong water drive which had developed. During the two and one half years from its discovery to the start of the gas injection program, the bottom hole pressure had declined from 2,048 pounds to 1,760 pounds. During the gas injection program the pressure had remained constant.

The Billings-Wilcox Pool in Noble county was discovered in January, 1936 and drilling proceded until 82 wells were drilled on 10-acre spacing. Of the 82 wells drilled, 72 proved productive. At present 54 wells are being produced, nine wells are being used for salt water injection and 11 wells are temporarily abandoned.

The pool is unitized with the exception of two wells on the southeast edge. Royalty interests were not unitized because of the large number of owners. Unitization became effective May 1, 1938. About 96 percent of the Unit is owned by four companies whose interests are approximately the same. These companies are Phillips, Shell, Continental and Tidewater, Phillips operating the Unit. In connection with the Unit, a gasoline plant was built which is owned equally by these four companies. As of June 1, 1946, 17.9 million of an estimated 33 million barrels original stock tank oil-in-place had been produced. Daily production now averages 41 barrels per well.

Gas injection was commenced October, 1938. Except for a short period, gas was injected until January, 1946 when it was discontinued. Of 19.25 billion cubic feet of gas produced to June, 1946, 6.73 billion was injected. Gas injection caused the formation of local gas caps in the vicinity of injection wells and resulted in an increase of gas-oil ratios in nearby producing wells. For this reason and since a strong water-drive was flooding the area and water was being produced, it became more expedient to re-inject water in place of gas for pressure maintenance. The return of water to the formation was commenced February, 1940 with small initial volumes gradually increasing and on January, 1946 the rate had reached 0.9 million barrels per month. As of June 1st, 1946, 29 million of the 30.5 million barrels of water produced had been returned. Subsequently, excess gas in gas-caps formed by gas injection was produced with a resultant reduction of high gas-oil ratios in nearby wells.

Because of the return of produced water and gas to the formation, bottom-hole pressure at 3100' subsea datum has declined only 221 lbs. per sq. in. from the original pressure of 1664 lbs. per sq. in. Utilization has enabled the operator to maintain reservoir pressure and it is reasonable to believe that from 2 to 4 million barrels of additional oil production over primary can be directly attributed to greater reservoir efficiency made possible thereby. This additional recovery may have been substantially greater had royalty interests been unitized in order to permit lower and more efficient production rates. Unitization has also had the beneficial effects of conserving and making natural gas and gasoline available to recovery and sale.

Gas injection has been used in Oklahoma in secondary recovery operations since 1924 when gas, or air, or an air-gas mixture was injected into the Bartlesville and Wayside sands in the stripper area of Nowata and Washington counties in the northeastern part of the state. The initial success stimulated a lot of activity and by 1926 more than 80 projects were operating or proposed. Expansion continued through the twenties, but fewer projects were started in the early thirties, and numerous projects were undertaken. In January, 1942 it was estimated that 16,000 barrels of additional oil daily was being produced in Oklahoma by gas injection.

The Cities Service Oil Company has been using gas injection since 1938 to repressure 1,200 acres in the extreme south end of the Oklahoma City field. Since the first of 1940 to the end of 1945, the leases have yielded over 4,700,000 barrels of secondary oil. The daily average production of the area in January 1946 was 3,200 barrels. If the repressuring program had not been started, the area would be yielding less than 1,800 barrels daily. Out of the daily production of 135 million cubic feet of gas, 80 million cubic feet is being returned to the producing horizon. Eighty-one wells are located in the area with Cities Service operating 51.

With 96% of Oklahoma's 52,000 oil wells classified as stripper wells averaging a few barrels per day, it is necessary that the newly discovered pools be operated at the highest efficiency. With the Anadarko basin in Western Oklahoma conceded to be one of the last large petroleum provinces in the nation, any new pools will be discovered by deep and costly drilling. The new pools may have production of the condensate type which requires recycling to gain the greatest ultimate recovery.

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BACTERIA IN OIL PRODUCTION

BACTERIA are microscopic organisms that cause putrefaction and spoilage of foods and are responsible for a number of diseases. Some kinds are useful to man and are employed to produce a number of articles of commerce. There are also some kinds that are of interest to the petroleum oil industry for their various desirable and undesirable activities.

Certain kinds of bacterial activity are undesirable because they result in corrosion of iron pipes and because they give rise to slimes that plug the sand faces in input wells. The latter phase of bacterial activity is especially disliked in connection with secondary oil recovery projects. Besides the bacteria that produce slime there are others which are able to reduce sulfates to hydrogen sulfide, which is well known as a corroder of metals. These sulfate reducing organisms are even able to draw the organic matter they require from the crude oil itself.

These bacterial activities are of sufficient concern to oil producers in the Bradford area to lead the Pennsylvania Grade Crude Oil Association to set up a microbiological laboratory for their study, under the direction of Dr. Jay V. Beck, who has found that most samples of input water in that area contain both slime bacteria and iron bacteria. In many cases plugging of sand faces in the input wells is serious, and results in lowering the water input rate. The examination of input water at one lease revealed fifty thousand and at another lease 20,000 bacteria per milliliter. These figures mean that about one-half ounce of bacterial cellular material is being added to the well with every one hundred barrels of water. It is apparent that this weight of slimy cellular material is sufficient in time to cause considerable plugging on the sand face. The wells on the above lease are now taking only three to four barrels per well per day. Another comparable lease showing only ten to one thousand cells per ml. was taking water at rate of 20 barrels per well per day.

It is apparent that some bactericide which would eliminate bacterial growths without causing other deleterious effects would be valuable. Many operators are using chlorine, hypochlorites, or copper sulfate to inhibit bacterial growth. Chlorine is an excellent bactericide but its activity is destroyed by contact with most organic matter. It is thus difficult to add chlorine in old systems in such concentrations that strong bactericidal action is present at input wells far distant from the site of chlorine addition. The corrosive action of high concentrations of chlorine prohibits its use over long periods of time at high concentrations.

Experimental data shows that chlorine treatment is effective against sulfate-reducing bacteria as well as against common aerobic bacteria. However, it must be remembered that it may be effective for only short distances from the point of treatment.

Tests have been started in the laboratory using various commercial bactericides to determine the feasibility of their use to produce more desirable flood water. Factors to be considered are (1) effectiveness, (2) cost, (3) lasting power, and (4) toxicity, since many people use the input water for drinking and home use. If it were not for this latter requirement a number of bactericides are known which would warrant field trials. It is believed the use of input waters having a pH of three to four would entirely eliminate the bacterial problem.

On the other hand, it is well known that certain bacterial species are able to oxidize paraffin. Investigations leading to the possibility of developing a species by selective cultural techniques that will destroy paraffin under the conditions that prevail in producing wells have been initiated in the Association's laboratory. It is hoped that such a species may be able to decompose the paraffin at a sufficiently rapid rate that its separation from the bulk of the crude will be prevented. This will make it unnecessary to stop production to remove the paraffin from the well or the lines by mechanical means.

Bacteria may play another role in petroleum production by their action in releasing oil from producing sands. Dr. C. E. ZoBell for several years has been working on the role bacteria play in the formation, migration, and transformation of petroleum hydrocarbon. As a result of his investigations, he concluded that bacteria have been effective in causing migration of petroleum from source sands to its present location.

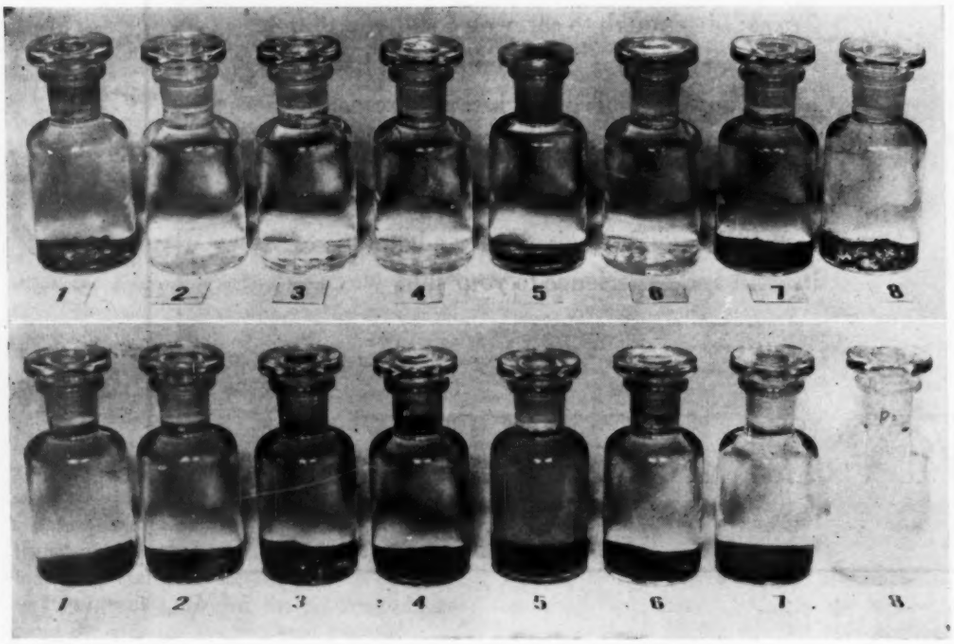
Doctor ZoBell has suggested several mechanisms by which bacteria may release oil from sands. The bacteria thought to have this capacity are decidedly thigmotactic, that is, they attach themselves firmly to solid surfaces and in so doing force adhering oil film away from the sand.

Bacterial activity usually results in carbon dioxide production. Carbon dioxide froms an acid which acts to dissolve carbonates and thus increase pore size and permeability, making it easier for the oil to be moved through the formation. Also, the carbon dioxide produced acts to reduce the viscosity of the oil which makes it flow more easily through the pores.

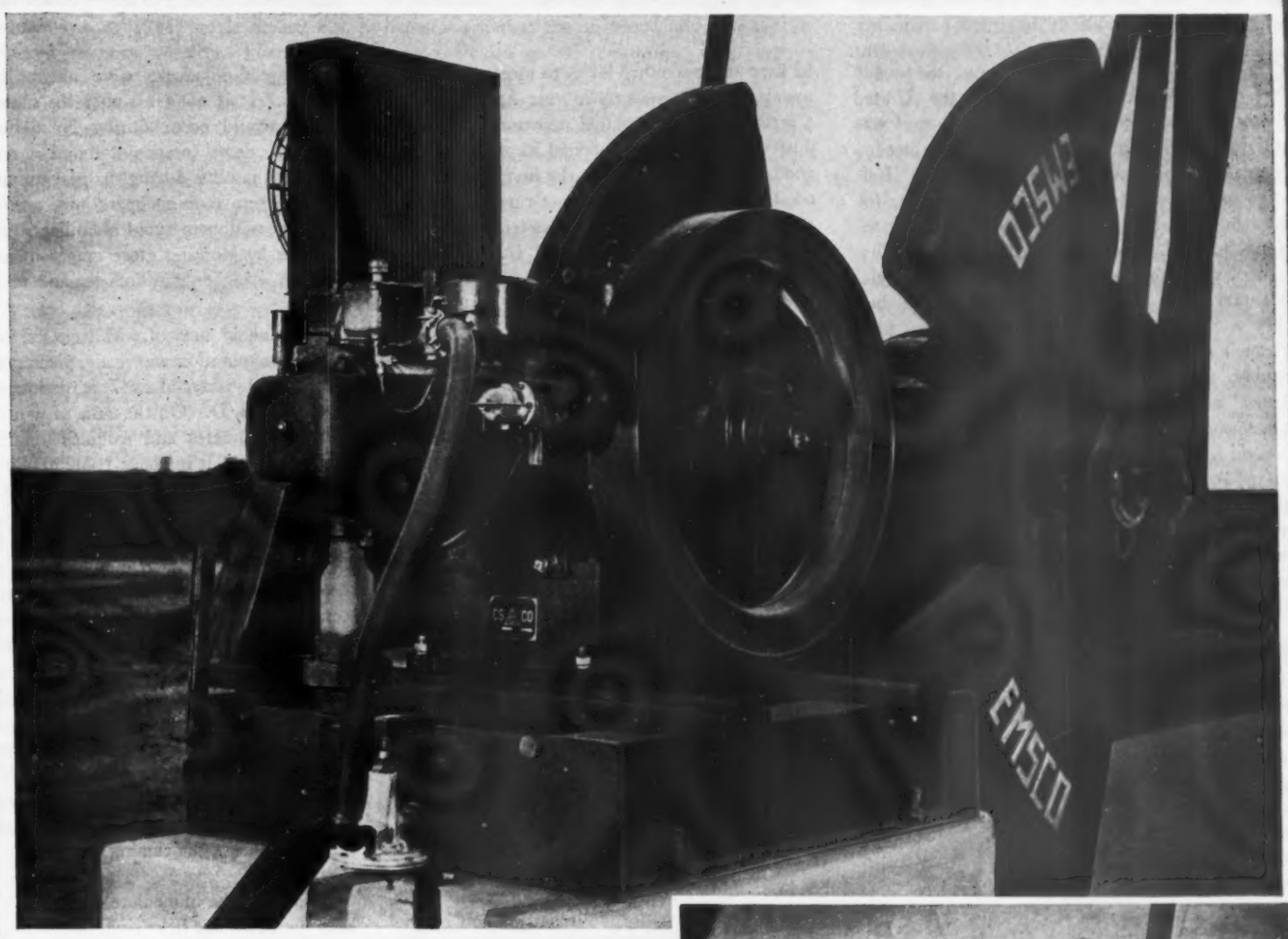
Many bacteria produce detergents which may be effective in release of oil from the sands. This action may be very effective, for bacterially produced detergents are produced at the oil-water interface where their action must take place if beneficial action is to result.

A satisfactory solution of any of the above mentioned problems will aid in increasing production by secondary recovery methods or will reduce production costs. With this in mind active research investigations are being carried out in the Pennsylvania Grade Crude Oil Association's microbiological laboratory.

Water samples from two leases tested for sulfate-reducing bacteria. Samples with dark precipitate indicate presence of such bacteria. Upper group of samples is from lease on which water was chlorine treated, lower group is from untreated lease.



Just Crank it... AND IT GOES!



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FUEL OIL DEMAND AND SUPPLY THROUGH 1950*

ON the first of October last year, the supply prospects for heating oils in the United States were none to promising. Price control was still in force and price adjustments were needed to get the requirements of these products. Relative to expected demands, stocks were low; for kerosene, about 13.7 milion barrels, and for residual fuel oil, about 42.8 million barrels. Distillates were not so bad at 45.1 million barrels. Military needs were beginning to taper off, but they were still substantial. As the winter progressed, gasoline needs fell off more than seasonably, for the most part due to rapid withdrawal of the military from the market, and requirements for kerosene, distillates and residual fuel oil increased rather sharply. It was not until mid-winter that partial price relief was granted. The crisis phase of the market disappeared, but supplies remained very short, particularly on residual fuel oil, the price of which was not increased until after the middle of March.

By contrast, the situation at the beginning of October, 1946 showed a substantial increase in supplies on hand. Kerosene stocks were 20.8 million barrels, instead of 13.7 million barrels, an increase of about 52 percent; distillate stocks totaled 59.8 million barrels, instead of 45.1 million barrels, an increase of about 300 percent; and residual fuel oil stocks were 52.4 million barrels, instead of 42.8 million barrels, an increase of about 22.5 percent.

These stock figures, although substantially above last year, may understate the real situation in kerosene and distillates. Domestic product demands in the first six months of 1946, as computed by the Bureau of Mines for kerosene and distillate, are not easy to explain. Indicated kerosene demand increased 22 percent over the like 1945 period and 32 percent over 1941; indicated distillate demand 7½ percent over 1945, and 35 percent over 1941. That was a surprise to everybody. For kerosene it might have been due to temporary housing, vacation travel filling tourist cabins, curing of tobacco and other like increases in end use. But for distillates, and to an extent for kerosene, it probably is accounted for by stocking that does not appear in the published inventory figures. If that is the case, there has been secondary stock build-up, a visible part held at refineries, bulk terminals and other storage which appear in the figures, and an invisible part held in distributors' tanks and perhaps in home storage, which does not appear in the figures.

Another feature of the present situation that stands in contrast with a year ago is that the military is expected to make substantially smaller drafts against fuel supplies for both on-shore and off-shore needs. Production of heating oils can be kept at satisfactory levels to meet expected demands and still come up to next April 1 without a serious depletion of fuel inventories. The industry will have demonstrated its ability to make good on its commitment in the first real test period it will have faced. It may turn out that, as an average over the fourth quarter of 1946 and the first quarter of 1947, total U. S. demands, including exports and bunkers, may come to about 351,000 B/D for kerosene, about 911,000 B/D for distillates, and about 1,350,000 B/D for residual fuel oil. That is a total of 2,612,000 B/D averaged over the period. Of course, the first quarter of 1947 is expected to be much higher than the fourth quarter of 1946, and both quarters are always higher than the warmer six months of the year. It should be noted that this estimate of requirements is considerably above the needs of last winter for both kerosene and distillates, and considerably less for residual fuel oil. In spite of decreased military requirements, the total for the three categories is somewhat above the actual total supplied in the same six months of 1945-46, which was 2,575,000 B/D.

What are the chances of meeting these anticipated increased demands without significant difficulty? A decline began in crude runs to stills in middle September and may be expected to continue. A definitely lower level of total throughout is indicated for the present quarter and for the first quarter of 1947. Otherwise, gasoline stocks would build up to undesirable levels in the off-season of its demand. This question of the effect of gasoline stock accumulation on total crude runs is really, under present circumstances, the heart of the problem of fuel supplies. On the assumption of fourth quarter crude runs of 4,650,000 B/D, compared with 4,861,000 in the third quarter, and first quarter of 1947 crude runs of 4,560,000 B/D, the expected requirements of kerosene, distillates and residual fuel oil can be met comfortably. The yields used in this computation are entirely within the range of industry experience and normal seasonal patterns. Imports of residual fuel oil and distillates were assumed at daily levels not greatly different from actual imports in the first seven months of 1946.

To get this conclusion, it was necessary to make an assumption regarding gasoline requirements during the next six month period, and compute probable gasoline stock build-up. On the basis of a 4,650,000 B/D average run in the present quarter and a 4,560,000 B/D average run in the first quarter of 1947, it works out to an indicated gasoline inventory of 110,000,000 barrels on April 1. There was some price weakness in the gasoline market in the early months of 1946 when gasoline stocks were about 105,000,000 barrels. It is not clear that the same price behavior would occur during Next February or March. Some companies found it necessary to purchase gasoline during the past summer in spite of maximum refining operations, and there may be a disposition to avoid a similar situation next summer by stocking more amply in anticipation of even a higher gasoline demand at that time.

To be doubly sure of fuel supplies, however, a second computation was made, placing crude runs in the first quarter of 1947 at the lower figure of 4,410,000 B/D. On the basis of winter gasoline demand estimates and assumed refinery yields, this would result in about 105,000,000 barrels of gasoline stocks on April 1, instead of 110,000,000 barrels. There are still plenty of fuel oils in sight to meet requirements even if this lower run figure is used. In fact, inventories of the major heating oil categories, on the basis of this second computation, which is the more conservative, are indicated on April 1 next year at 10,400,000 barrels of kerosene, 40,300,000 barrels of distillates, and 43,800,000 barrels of residual fuel oil.

These are figures that are considerably in excess of stocks for these three major products on April 1, 1946. They suggest that all demands for the major heating oil categories can be met without difficulty during the coming winter.

So much for the immediate future. We can all keep warm for the next year, but can we all keep warm for the next five years? So far as we can see ahead, there are no serious difficulties to be expected through 1950. A lot of variables are involved in any long range estimate but it looks as though crude runs will have to average the following to meet estimated kerosene and distillate demands:

1946	4,740,000 B/D
1947	4,750,000 B/D
1948	5,020,000 B/D
1949	5,070,000 B/D
1950	4,980,000 B/D

These figures suggest several observations. It appears that domestic crude production may have to be increasingly supplemented by crude imports during the period even though crude exports may tend to decline slightly over the five years. In 1950, needed crude imports may be somewhere between 350,000-400,000 B/D, compared with an average of 233,000 B/D in the first seven months of 1946. Although that amount of crude is not available for importation today, it presumably will be available from increased foreign production by 1950.

Estimates of gasoline demand during the 5-year period, relative to the demands that have been estimated for kerosene and distillates, require no serious distortions from present yield patterns

* Condensed from an address before Empire State Petroleum Association by Dr. Courtney C. Brown, Coordination and Economics Department, Standard Oil Co. (N. J.)

to fit with overall product demands. There is one major point that should be made, however. The level of refinery runs to meet these estimated product demands after 1947 equals or exceeds present maximum refining capacity. That means that the opportunities to adjust production at the refinery level to conform to the seasonal pattern of heating oil demands will not be as great as was the prewar case when refineries typically ran well under capacity. It is not so much a refining problem as it is a marketing problem. If refineries are going to have to operate close to maximum all year round to meet the full year's requirements for gasoline there is not going to be as much opportunity as formerly to increase the gasoline fraction during the warm months and decrease it during the cold, and the same is true for kerosene and distillates.

This has a lot of significance for the industry in the way it handles its stocks in the future. In simplest terms, it means that the seasonal demand patterns for the several major products must be increasingly cushioned by stock building in off-seasons, rather than by adjustments of product production at the refinery level. Heavier inventory build-up in off-season will require greater tankage capacity or more flexibility in the use of existing equipment. It may be that further study of the situation will disclose many opportunities to put gasoline in space made available by drafts on heating oils as the winter season progresses; conversely, to put heating oils in space made available by drafts on gasoline during the heavy driving season. To the extent that refineries lose flexibility because of heavy overall demand flexibility must be picked up at the storage level if ample petroleum products of all kinds are to be assured at all times.

Little has been said in this discussion of the demands and prospective supplies for residual fuel oil. That is because the assumption has been made that "resid" will continue, as its name indicates, as the fraction left of the barrel of crude after other product demands have been met. The computations used to reach the conclusion that anticipated demands of major products will be met during the five years through 1950, have involved a gradual decrease in yields of residual fuel oil, starting at 25 percent in 1946 and falling away to 20.6 percent in 1950 That means that the supplies of residual fuel oil, including imports to the East Coast, are expected to decline during the period from about 1,345,000 B/D in 1946, to 1,192,000 B/D in 1950. This is still a lot of residual fuel and the decline is not very steep. It looks as though the residual fuel oil requirements of present consumers during the next six months will be just about met, perhaps with a little margin to spare, but over the longer period to 1950, it appears that supplies of residual fuel oil from domestic crude will diminish, and a part of the present residual fuel oil market, perhaps in the interior of the country, may have to be surrendered to other types of fuels.

"PLUTO" SALVAGED FROM CHANNEL

The cross channel gasoline pipelines which delivered one million gallons of gasoline daily to Allied Expeditionary Forces in France and Germany during the war are being salvaged by the British government. Metal from "Operation Pluto" will be employed to aid the British housing program. It is estimated that 10,000 tons of lead will be available from the lines.

The S. S. Empire Ridley, a former cable ship, has been assigned the task of reeling in and stowing the pipe in its capacious forward and aft holds. A. C. Hartley, chief engineer of Anglo Iranian Oil Company, who was responsible for developing Operations Pluto as a practical subsea pipeline system, was present on the Empire Ridley when salvage operations were begun.

Operation Pluto was begun as soon as approaches to the Cherbourg peninsula were swept clear of mines. Four line were laid from the Isle of Wight to Cherbourgh in 10 hours. Sixteen were laid from Dungeness to Boulogne within five hours.

Two type of line were laid. The first was 3-inch continuous conduit built and laid from ships like a submarine electric power cable and known as HAIS from the names Hartley, Anglo-Iranian and Siemens. The second type of line was welded steel made in 4,000-foot lengths and rolled on huge drums carrying 70 miles of line, enough for an entire cross to France. The drums were towed across the channel paying off the pipe as they went. The steel line was given the name HAMEL from the names of H. A. Hamick, chief engineer of Iraq Petroleum Company and B. J. Ellis, chief oilfields engineer of Burmah Oil Company.

When the lines were being laid three merchant vessels were fitted out to lay HAIS in deep water with auxiliary barges for shallow water. There were six drums built for towing in the channel and laying HAMEL pipe. All told, the force employed in the line laying consisted of 100 British officers and 1,000 men. Operation of the lines saved untold quantities of men and shipping and immeasurably speeded the advance of the Allied armies.

Feeding 'Pluto" into the "wellhold" on the aft deck.

S. S. Empire Ridley lifting "Pluto" from the ocean bed.

DAMPENERS NEUTRALIZE EFFECTS OF GAS PULSATIONS

By FOSTER STEPHENS*

THERE are many secondary effects of pulsative gas flow which are usually more easily recognized than the original source itself. One of these is vibration, which is often objectionable in gas compression plants, refineries, gasoline plants, recycling plants, or in most cases where gas, air or steam is being compressed. There seem to be no pressure ranges from vacuum to 5000 lbs. per sq. in., that are free in all instances from line and equipment vibrations. Many factors enter into the degree of pipe vibration, such as type of supports, spacing and whether the system is overhead or on the ground. It likewise has been observed that expansion loops and general piping arrangements may be contributors to excessive vibrational displacements.

Unfortunately, for the sake of pipe and equipment, excessive accelerations, which are a function and measure of vibrational stresses, can often be measured where the piping is securely fastened and there is a minimum of visible shaking present. This has particularly been noticed in some cases where expansion loops are placed horizontally and securely clamped. In many instances the results of the continuous acceleration stresses results in shearing of the bolts in the pipe clamps or shattering of the concrete pipe supports. Usually compressor discharge lines are worse offenders than compressor suction lines as far as mechanical vibration is concerned. There are, of course, exceptions to this which may be caused by mechanical or acoustical resonance in the suction system.

Aside from vibrational effects, pulsative flow is a chief contributor to inaccurate orifice metering, resulting in errors in excess of twenty percent in some instances. Phenomenal cases have even been reported in which the meter showed the gas to be flowing in a reverse direction from the actual flow. These metering errors are often experienced regardless of whether the meter run is located on the suction or the discharge side of the compressor. Remote locations of metering stations from the compressor station does not always solve the metering problem, for there are many times when the pulsative flow is known to be present in the gas stream many miles from the compressor station.

Pressure gage readings fall into the same pressure fluctuating disturbances as meters and there are many instances when it is practically impossible to get an accurate pressure reading in the proximity of a compressor station due to the gage responding to the pressure pulsations.

Horsepower loss due to pulsative flow represents an exceedingly complicated story when considered from all angles. On the discharge side, high instantaneous pressures may be produced in compressor cylinders because of discharge line pulsations. This often occurs when several compressors are operating in tandem and discharging into a common header. Likewise reflections can be produced from pipe bends, valves or other abrupt changes in gas flow conditions. The result of this type reflection is again that of high instantaneous peaks.

Another horsepower loss is the extra pressure drop required to drive a pulsative flow through a transmission line. Due to the high instantaneous velocities achieved at the pulse peak, the pipe frictional effect is in excess of what would be encountered for a steady flow.

On the suction side of the compressor pulsations can create cylinder starvation at one instant and a super-charged condition the next instant. We have observed cases where engine speed hunting was so bad that it was impossible to operate all engines at the same time.

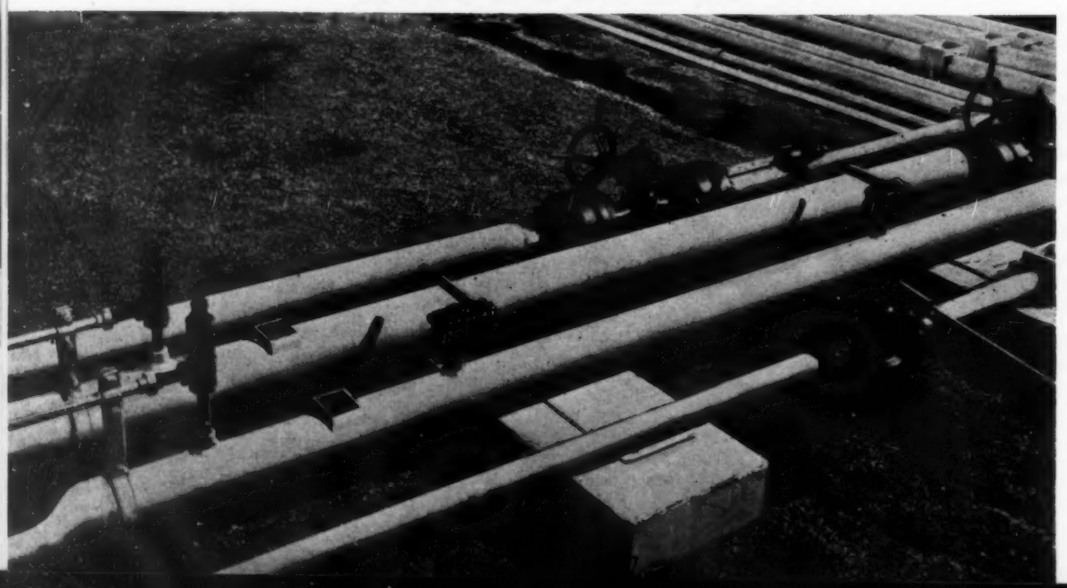
There naturally have been corrections applied to many of the previously described problems as they appeared in the field, resulting at least in partial solutions to the problem. Many of these corrections have been by trial and error and, therefore, do not represent a universal solution.

In the case of pipe vibrations, various arrangements of piping have been tried and while it is beyond the scope of this paper it may be said in general that some are decidedly better than others in this respect. The usual procedure when excessive vibration displacements are observed has been to tie down the points of excessive displacements structurally. There have been occasions when this resulted in a shift of the point of maximum displacement to some other part of the piping system, thereby creating the necessity for additional structural supports. In many instances it has been necessary to repeat this procedure several times before the entire problem was corrected. In this connection it should be pointed out that it is virtually impossible to predict and space piping supports in such a manner as to be non-resonant to all the varying frequencies and beat frequencies of pulsation that may result from several compressors running at varying speeds and discharging into a common header. For a single compressor running at fairly constant speed, however, there are certain predictable pipe spans that should be avoided and these can be calculated with a fair degree of accuracy.

Another method has been utilized in recent years for decreasing the magnitude of piping vibration. It consists of installing mechanical vibrational dampeners at certain strategic spots in the piping systems. These mechanical dampeners have been made in various forms. They usually consist of combinations of weights and springs, weights and rubber, or just springs. The principle employed by these devices is that of changing the natural frequency of the vibrating member or of absorbing the vibrational energy by being resonant to the vibrational frequency. The disadvantages of these devices are that usually they are only a partial cure for the trouble, and require exact location and adjustment to be effective.

To keep metering errors at a minimum, many systems have been used. The simplest of these

Pulsation dampeners installed on 4,000-pound and 1,500-pound pressure discharge headers at a cycling plant.



* Principal Research Engineer, Development Dept. The Fluor Corporation, Ltd.

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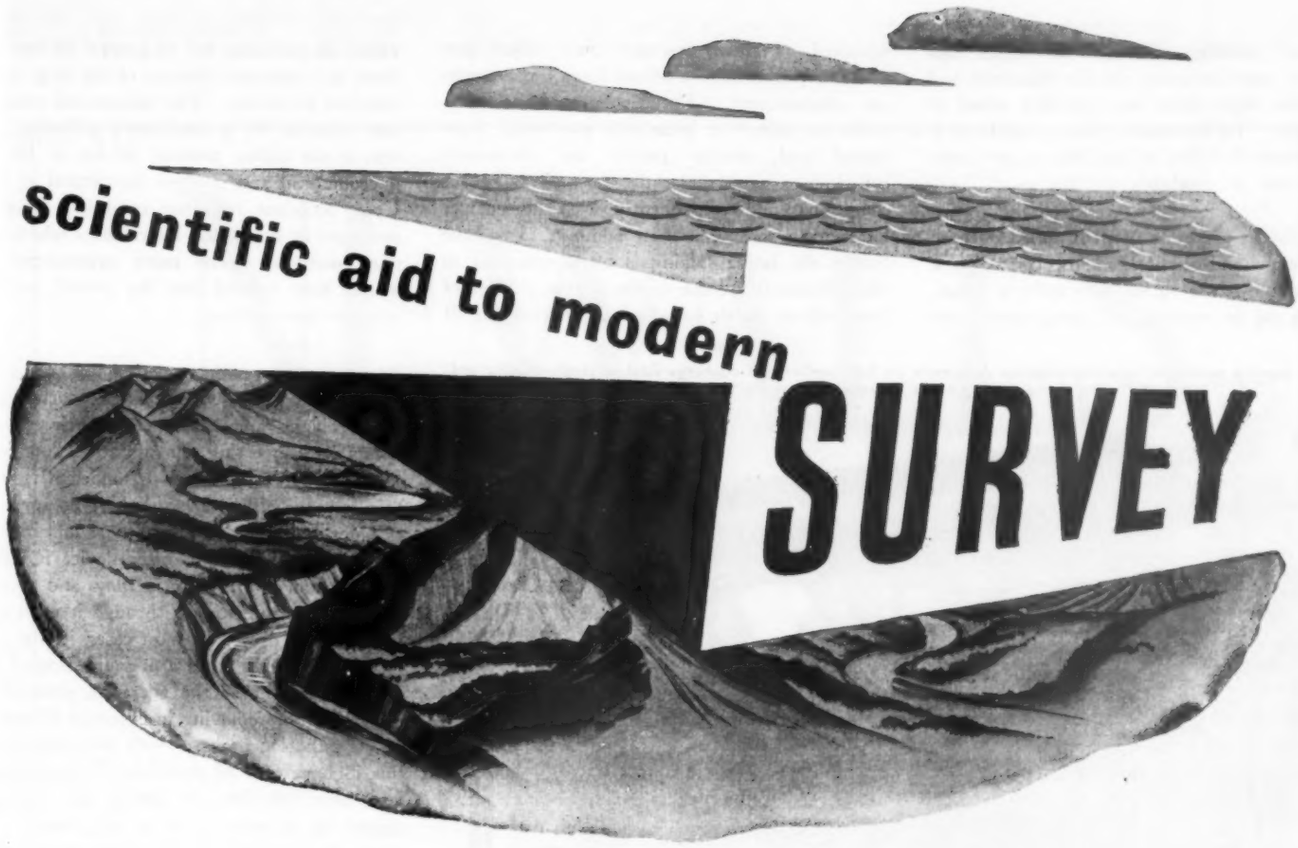

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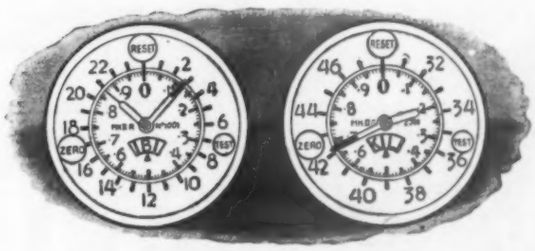

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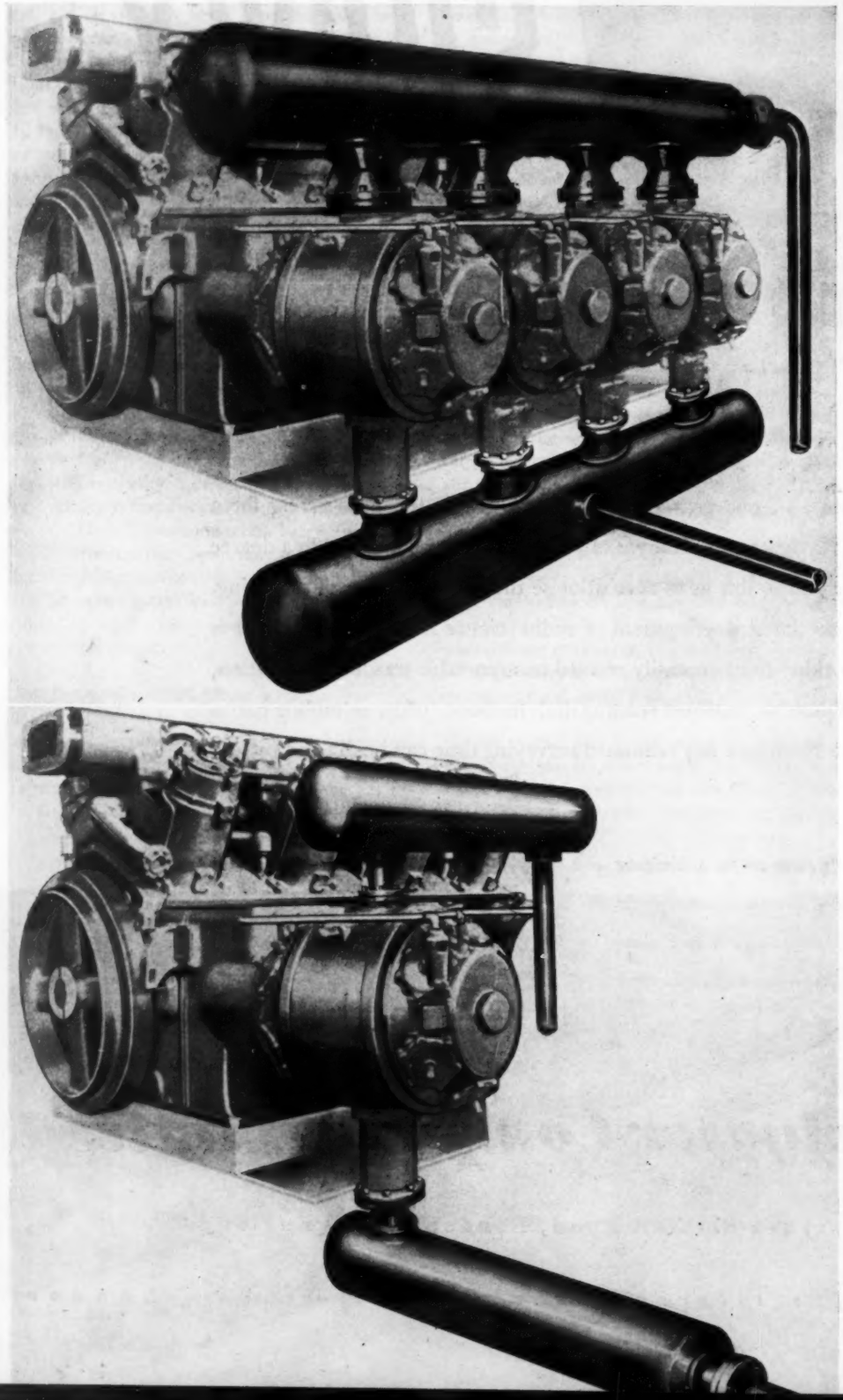
consists of pinching valves in the meter lead lines. In some instances volume chambers and even orifice plates have been installed ahead of meter runs. To summarize these procedures it may be stated that they at least help to get meter readings that are readable.

Volume bottles are quite often installed on both the discharge and suction side of compressors. Their volume often varies over quite a range, depending on the pressure and compression ratio involved. In many instances their cubical contents vary from five to fifteen times the compressor displacement. Their purpose is to minimize the effect of reflections previously mentioned and thereby permit the compressor cylinders to work under the most advantageous conditions, and consequently keep horsepower losses at a minimum. In addition to volume bottles the lateral piping is often oversized to add additional volume to the system. Most of these volume bottle installations improve the ill effects of pulsation but in general do not reduce them to a minimum because of the large volumes required to do this. The volume and consequent size required for a satisfactory pulsation reduction in the higher pressure services is extremely uneconomical and is often impractical to locate. Upon occasions reasonate conditions have been produced by bottle and lateral sizes where pulsative conditions were more pronounced than would have existed had no partial corrective measure been applied.

Two views showing method of installing pulsation dampeners on both suction and discharge sides of single-cylinder and four-cylinder compressors operating in parallel.



The pulsation dampener, designed on a filter principle, has been widely used to correct pulsation problems and consequently their secondary effects by converting the pulsative flow into a steady flow. The design is sufficiently flexible to allow for either a manifold type for multi-cylinder service or an in-line type for single cylinder service. Being a filter device it offers a high resistance to a pulsative flow and permits a steady gas stream to pass through it with a very low pressure drop. In most cases, it is practical to design dampeners for a pressure drop of about one-half percent of the operative pressure that are capable of removing in excess of 95 per cent of the pulsation peaks. With the elimination of this high percent of pulsations it naturally follows that vibration in piping and equipment caused by pulsative flow is eliminated. This means that elaborate hold-down systems and mechanical dampeners may be eliminated. It also follows that any errors in metering due to pulsations are automatically eliminated by the removal of the pulsations.

Improvement in compressor cylinder conditions by the installation of pulsation dampeners may be divided into two classes which are, namely; installation on discharge and installation on suction side.

Installation of dampeners on the discharge side of compressors results in the removal of pulsations on the high pressure laterals, headers and equipment. The compressor cylinders are naturally working under a more advantageous condition in this instance because there can be no reflections, resonate conditions or standing waves which can create unusual instantaneous pressure conditions within the cylinder during the interval that the discharge valve is open.

On the suction side of compressors the installation of dampeners results in a uniform pressure condition at the time the suction valve is open. This prevents the previously mentioned condition of starvation at one stage and a supercharged condition at the next, and results in a uniform suction pressure condition for the compressor.

One other factor in plant design is worthy of mention and that is that all piping and equipment may be sized for steady flow if dampeners are to be installed, thereby eliminating the effect of oversizing for pulse peak velocities.

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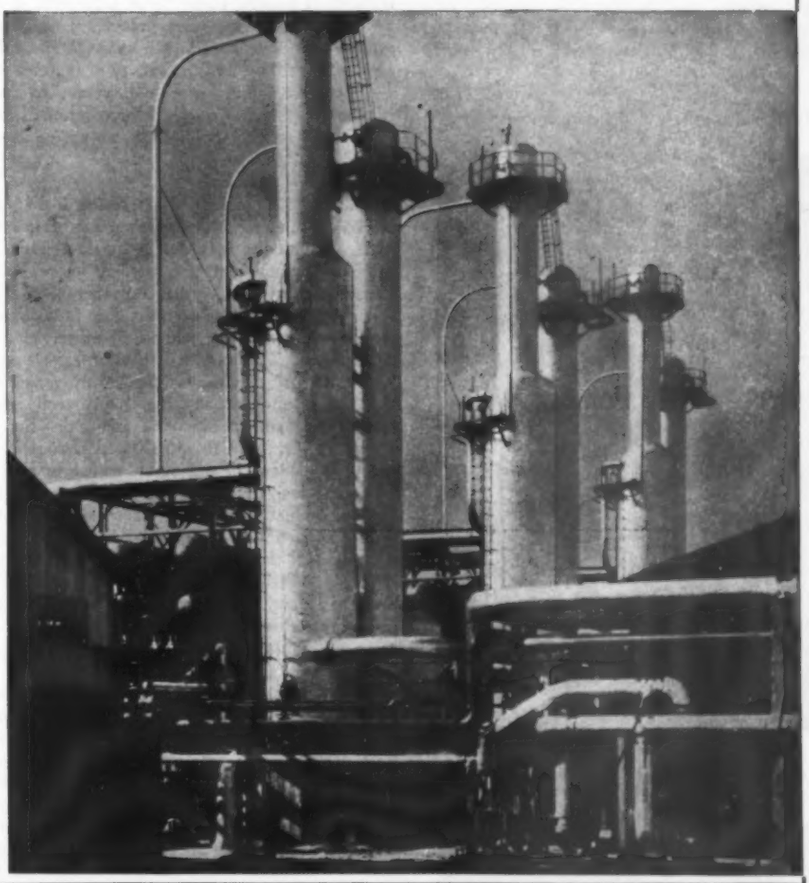

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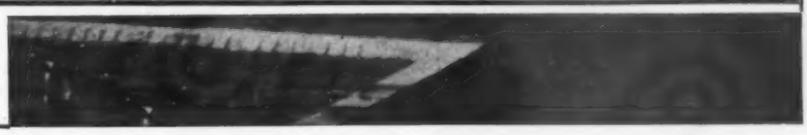
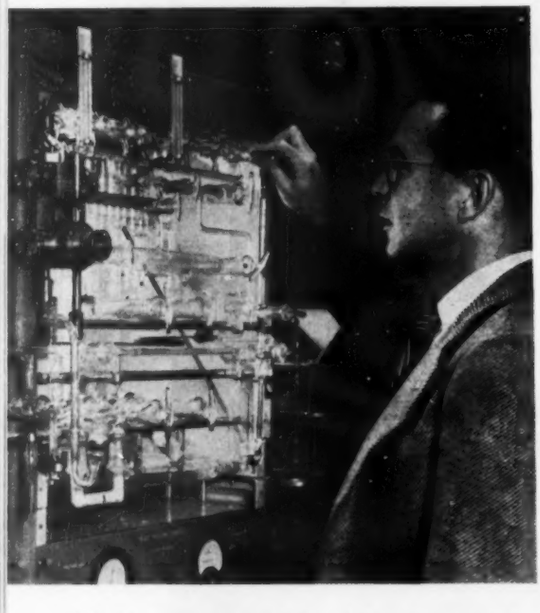


APPLICATIONS OF THE MASS SPECTROMETER

By HAROLD F. WILEY*

WHEN the Mass Spectrometer was first brought to the notice of the oil industry, only a few years ago, it was a machine of deep mystery even to the technically well informed oilman. Even today the average analytical chemist might not be able to give a very clear account of its theory, construction and operation, but he knows that it is a mighty versatile instrument giving quick answers with high accuracy to many tough analytical problems. Nearly all the larger oil companies now use one, two or three Mass Spectrometers for around-the-clock analyses of plant streams and pilot plant samples, in the search for better methods and products and the study of fundamental processes. In the laboratory it is an essential tool regularly used for a number of different groups or types of analyses. Control samples, requiring the determination of just one or two key components, are an example of the group which may be analyzed very rapidly. Typical analyses are the determination of isopentane in debutanizer overhead, propane in depropanizer bottoms and pentenes in isoprene or butenes in butadiene.. Analyses of this type may be made in about 25 minutes.

Sample introduction system of the mass spectrometer.



Electrical computer used for solution of up to twelve linear simultaneous equations.

Samples requiring complete analysis, or the complete analysis of their lighter fraction obtained by preliminary stripping, are examples of the second group. Complete analyses of overhead products from fractionation units are typical; also, fractionating unit feeds and bottoms which have been stripped of high concentrations of C_6 and heavier. Thermal cracking products are another example. Samples in this group require from one to four hours for an analysis.

Research and development laboratories usually have analyses of the second group from pilot plant operation. In addition, they are called upon to analyze samples containing appreciable quantities of C_6 and heavier components. These require preliminary fractionation to separate the sample into a number of cuts containing not more than ten components each; then each cut is analyzed on the Mass Spectrometer. The analysis of an alkylate through the C_8 region is one such problem. These laboratories are, of course, likely to be interested in almost anything originating from petroleum or petroleum processing. Fischer-Tropsch samples and mixtures of oxygenated materials are two samples of this very board field. Here the versatility of the commercial Mass Spectrometer, the small samples and the short time required to obtain analyses are major factors.

A glance at a simplified operational diagram of the Mass Spectrometer and then at the instrument itself, accents the fact that a lot of electronic circuits and equipment are needed to perform the basic functions of molecular separation and counting. What kind of a specialist does it take to operate the equipment and what kind of magician keeps it working? The answer is that an expert and magician are not needed. The operating and supervising personnel of any reasonably well equipped laboratory can operate and maintain the Mass Spectrometer. High quality components and practical modern design make operation and maintenance relatively easy. The installation and testing of the instrument and the training of the personnel by the manufacturer's representatives, smooth out the rough spots encountered in getting any instrument into routine operation. Expert assistance when needed, and readily available replacement parts, insure continuous operation at high efficiency.

The first commercial model of the Mass Spectrometer was produced by quickly converting a thoroughly tested laboratory instrument into a practical industrial design. The aviation gasoline and synthetic rubber programs were expanding at a tremendous pace and the need for analytical apparatus was so great that further instrument development had to be suspended in order to meet production demands. The modifications which did go into the first model were refinements rather than basic changes.

The first major improvements in the Mass Spectrometer are incorporated in a recently announced new model. These improvements add further to the value of the apparatus by improving its accuracy and efficiency and by reducing the operating personnel requirements. The changes provide for the automatic monitoring of critical electron streams and for the automatic regulation of the temperature of the ionization region or "heart" of the entire apparatus. Changes in the focusing of the electron and ion beams are also incorporated in the new model. These all add up to more stable operation and a more favorable ratio between the calibration and maintenance time and the operating time. Further developments, now in process, are aimed at increasing the versatility of the apparatus and lowering the operating costs. As with the improvements just mentioned, these will be designed to apply to existing models to avoid rapid obsolescence of the apparatus now in service.

It has been apparent for some time that a faster method was needed for computing the data obtained on the instrument. Fifteen to twenty fiive component mixtures could be run on the Mass Spectrometer in almost as short a time as five to ten component samples, but the computation time was very much longer for the more complicated samples. The average refinery laboratory required a computing staff of two to four people to keep up with one instrument operator turning out twelve to twenty analyses per shift.

This problem was partially solved by the development of an electrical computer of sufficient accuracy for mass spectrometer data. With this electrical computer, a more equitable balance is maintained between instrument time and the data computation time. Besides providing quicker answers, the electrical computer simplifies the whole computing procedure, reducing the chances of error and allowing the employment of less skilled personnel.

With the provision of more laboratory space, petroleum refineries and development laboratories have recently shown a decided spurt of interest in using the Mass Spectrometer. The application of the instrument to research problems accounts for a fairly large part of this interest, since the Mass Spectrometer had an impressive record as a research tool before commercial instruments were available.

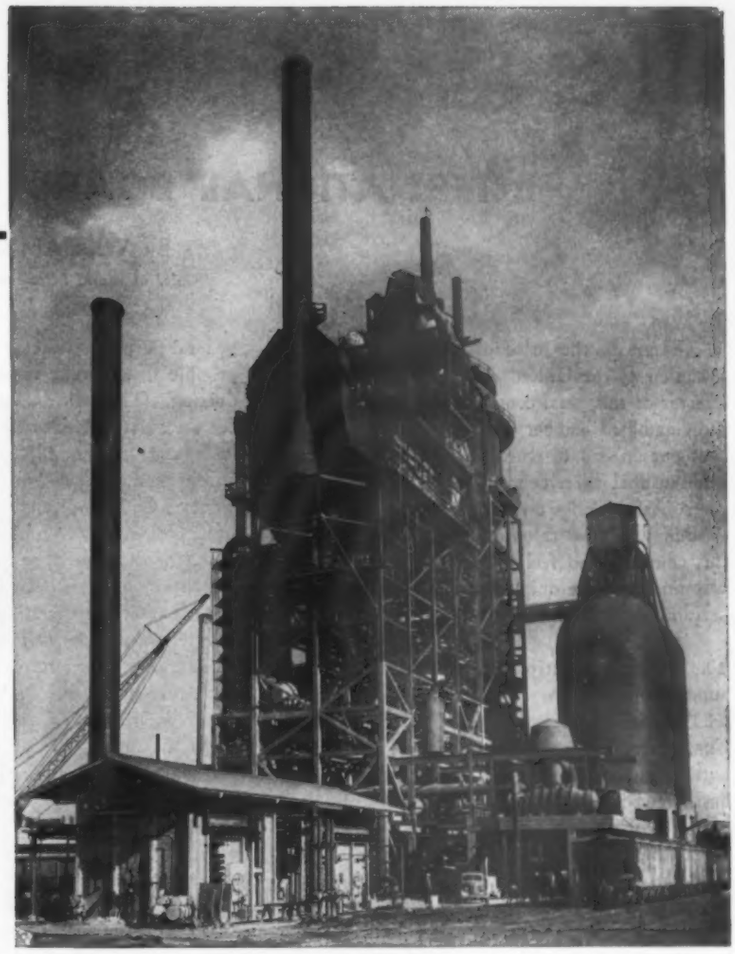
Problems of fundamental importance to the refining industry are scheduled for study in major laboratories throughout the country, and the Mass Spectrometer will play an important part in the solution to some of these problems. Studies of the mechanism of reactions, employing the stable isotope of carbon, are but one example of the new line of attack.

New plant construction and the opening of foreign markets account for another large share of interest. The problems of exporting an instrument of this type are admittedly fairly difficult as compared to domestic installations. These problems have been overcome, however, in several instances.

One of the major postwar applications of the Mass Spectrometer is in the petro-chemical and general chemical fields. Besides hydrocarbons, the Mass Spectrometer can be used for the analyses of mixtures of inorganic gases, chlorinated hydrocarbons, oxygenated compounds, nitroparafins, mercaptans, iodides, sulfides and terpenes. In fact, with the exception of water vapor, practically any gas or liquid with a sufficient vapor pressure can be run on the commercial instrument as it exists or after fairly minor revisions.

Although far afield from petroleum and petroleum products,, it is of interest to note that medical and biochemical research may make considerable use of Mass Spectrometers in studies of cancer and body chemistry.

* Consolidated Engineering Company.



415½ days

CONTINUOUS RUN...

A RECORD FOR FLUID CATALYTIC CRACKING UNITS

THE TIDEWATER Associated Oil Company, at its refinery at Avon, California, has recently completed a run of 415½ days. This run of nearly 14 months continuous operation is a record for fluid catalytic cracking units.

During this period the unit processed approximately 8,000,000 barrels of fresh charge exclusive of recycle. Early in the run it was operated largely on straight run gas oil of 30° or higher A. P. I. gravity. At times various naphthas, both straight run and cracked, were charged as supplementary charge to maximize aviation gasoline production. Since the close of the war, the charge was gradually made heavier and for the past several months has been primarily a heavy California waxy distillate of high viscosity averaging 22° to 23° A. P. I. gravity.

Since the beginning of post-war operation, catalyst costs have averaged approximately two cents per barrel of fresh feed charged. Catalyst activity has been maintained at relatively high levels as indicated by the space velocities employed during the run.

This Tidewater unit is just one of the many fluid catalytic cracking units designed by Universal Oil Products Company.

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UNIVERSAL SERVICE PROTECTS YOUR REFINERY

INTERNATIONAL BOARD ENDS RUBBER CONTROL

By WILLIAM J. MADDOX

Chief of World Petroleum's Washington Bureau

THE cut in the price of natural rubber purchased by the United States during the fourth quarter of this year, coupled with the decision of the Combined Rubber Committee to disband and thus put an end to world controls, points up an international agreement to let the price of natural rubber seek its own level. Such a policy is in line with the thinking of manufacturers of this country who feel that synthetic rubber can best find its place only in a free market, in competition with the natural variety.

The lifting of controls came in a simultaneous announcement from London and Washington, which said tersely: "The Combined Rubber Committee, having recommended allocations of natural rubber for the fourth quarter of 1946, has agreed in view of the increased quantities of natural rubber becoming available that international allocation control need not continue beyond the end of this year. The member governments have therefore agreed that the Combined Rubber Committee be terminated as of December 31, 1946."

The cut in price to the United States followed discussions between representatives of this country and the United Kingdom. The reason given was that production of rubber in Malaya has increased more rapidly than was foreseen at previous meetings in London last June and its orderly marketing is essential.

As a result of the Washington discussions, the RFC, through its subsidiary, Rubber Development Corporation, will seek to purchase from Malaya all natural rubber allocated to the United States by the Combined Rubber Committee from U. K. sources up to a total of 200,000 tons, at 20¼ cents (U. S. currency) a pound for standard sheets delivered f.o.b. ocean-going steamer at Far Eastern ports through December 31, 1946. This quantity is in addition to the amount already purchased under the agreement announced June 21, 1946.

To the extent that it may not be possible to provide for the total quantity of 200,000 tons to be shipped from Malaya to the United States during the contract period, shipments will be made from stocks in the United Kingdom at the equivalent price of 22¼ cents (U. S. currency) for standard sheets c.i.f. United States Atlantic ports.

An interesting question is the effect abandonment of control over natural rubber will have on the synthetic rubber industry built up in the United States during the war. Striking progress has been made in reducing the production cost of general purpose synthetic. After V-J Day it was possible to eliminate some of the high cost production. This, with more efficient operation, has cut the average cost of the main type to less than its selling price of 18½ cents established by the government. The United States, according to John L. Collyer, president of the B. F. Goodrich Company, can now produce about 600,000 tons a year of the main type rubber at a plant cost of 12 cents a pound, or less. Even counting in plant amortization, depreciation, distribution, expense and return on capital invested, American industry could produce, he says, up to 600,000 tons for between 15 and 17 cents a pound.

Until the supply position is such that crude rubber and American-made can meet in outright competition, it is impossible to get a true picture as to how preference for crude rubber will stand up with the differential in price in favor of the American-made. In the meantime, the rubber companies will have a chance to push their experiments aimed at finding a good mixture for natural and synthetic.

"Undoubtedly the selling price of crude could come down to meet competition if necessary," says Collyer. Before the war crude rubber could be laid down in New York by efficient producers, and with a fair profit, at 10 cents a pound.

N.P.C. Organizes

At its first real business meeting, given over largely to organization problems, the new National Petroleum Council voted to continue Walter S. Hallanan as temporary chairman and Russel B. Brown as temporary secretary, directing the former, however, to name a committee to nominate a permanent chairman and vice chairman. The organization plan calls for a permanent secretary-treasurer, and provides for a budget not to exceed $50,000 a year and for an office and small secretarial staff to be established in Washington for handling Council business between the quarterly meetings.

Three other proposals submitted by Ralph K. Davies, acting director of OGD, for council study, on which no action has yet been taken by the agenda committee because of their relatively less pressing nature, are: (1) The assembly, compilation and analysis of petroleum statistics on a world-wide basis, as recommended by PIWC before its dissolution last December; (2) A program of statistical work relating to the future availability of fuels for military aircraft, in conjunction with the Bureau of Mines, requested by the Army Air Technical Command; and (3) Various questions relating to the adequacy of domestic reserves, the importation of crude and its products, of access to foreign reserves, and what action should be taken by the government to assure the adequacy of oil supplies for the U. S.

Haslam on Competition

With Attorney General Tom Clark seated at his right at the guest table as an interested listener Robert T. Haslam, vice president of Jersey Standard, gave the Washington Advertising Club an insight into free-enterprise and competition as "America's Real Resource." Haslam had recently returned from ten months' traveling that took him into fifteen countries, a sort of round of contact-renewals with foreign branches of the company that have had to shift largely for themselves because of the war.

"American competition is tough, but it is not without rules," Haslam told the ad men, and turning to Clark explained that this part of his talk was prepared before he knew the Department of Justice chief would be present. "Most of these rules are unwritten, tacitly recognized ones. But a number of broad principles have been framed in law or otherwise formally established. For example, the American conviction that competition is a good thing finds expression in the Sherman and Clayton anti-trust acts.

"Although our businessmen sometimes complain loudly about these laws, I believe this occurs because of ambiguities in the statutes or when they feel that the laws are being unfairly interpreted or administered and does not arise from any disapproval of the laws themselves. The Federal Trade Act and the Robinson-Patman Act are other instances of rules of fair play."

The fact that the United States has such a large proportion of the world's resources, such as petroleum, isn't so much that we have more of these materials as that we have been more energetic in seeking and developing them, he pointed out. To date we've discovered about two-thirds of all the oil found in the world "simply because any person in our country can win the rewards of finding oil, so there are more Americans looking for oil than there are in any other nations."

Haslam threw out the thought that atomic power may compete with oil as an energy source. "But the oil industry, which is most active in scientific research, is not in despair," he asserted. "It believes that ample opportunity will be found for the use of all energy sources and that, even if the atom should supplant petroleum in some cases, it will be entirely possible to find new and useful employment for the oil thus displaced."

Under a single, consolidated authority, action is synchronized, no motion is wasted. Without unified control, results can easily become chaotic. In refinery or petro-chemical plant construction especially, unified control helps mightily in getting the right things done in the right way at the right time. Consider:

1 Analysis of manufacturing requirements and methods.
2 Process design.
3 Mechanical engineering.
4 Materials procurement.
5 Expediting and delivery scheduling.
6 Disbursement and cost accounting.
7 Labor relations and planning.
8 Erection and installation.
9 Initial plant operation.

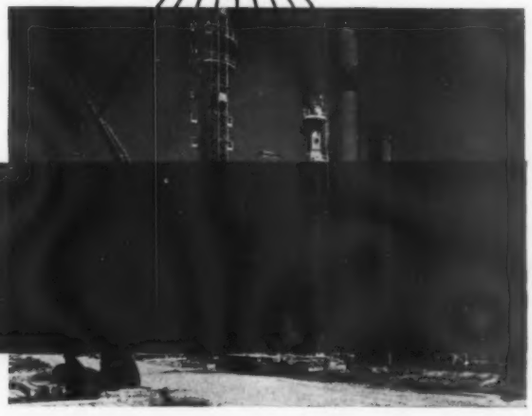
This makes how ably these individual functions may be performed, confusion, delays, misfits and mistakes are almost inevitable . . . hence more is needed co-ordination by a responsible central organization which is experienced in all of the phases of the project.

The Badger organization's ability to take charge of plant construction is founded on a wealth of experience in both detail and supervisory capacities.

Thoroughly experienced Badger specialists perform each function—under a central technical and business management that has actually "lived" with the petroleum refining, petro-chemical and chemical developments of this generation of progress.

1 2 3 4 5 6 7 8 9

Badger



Badger

International News and Notes

James Tanham

JAMES TANHAM, vice president of The Texas Company in charge of industrial and public relations, was appointed by President Truman as an advisor to the American employer representative at the International Labor Organization conference at Montreal, Canada. Mr. Tanham last served by presidential appointment as an industry delegate to the labor-management conference in Washington last November. From October, 1944, to May, 1945, he was chairman of the industry members of the National War Labor Board. His present appointment was recommended to President Truman by the United States Chamber of Commerce and the National Association of Manufacturers.

War Activity Depicted

W. P. Butterfield Ltd., engineers and tank manufacturers of Shipley, Yorks, England, has published a beautifully illustrated booklet describing the six-year war production record of the company. Fortunately, the plant never was damaged by enemy bombing and, hence, was able to operate at maximum efficiency throughout the emergency.

Tanker construction which constitutes a major part of the company's peacetime activity, was continued during the war. Tankers built included more than 5,000 aircraft fuelers, more than 11,000 petrol tankers and more than 5,000 water tankers. Over 60,000 auxiliary water tanks were manufactured for the R.A.F. and emergency use.

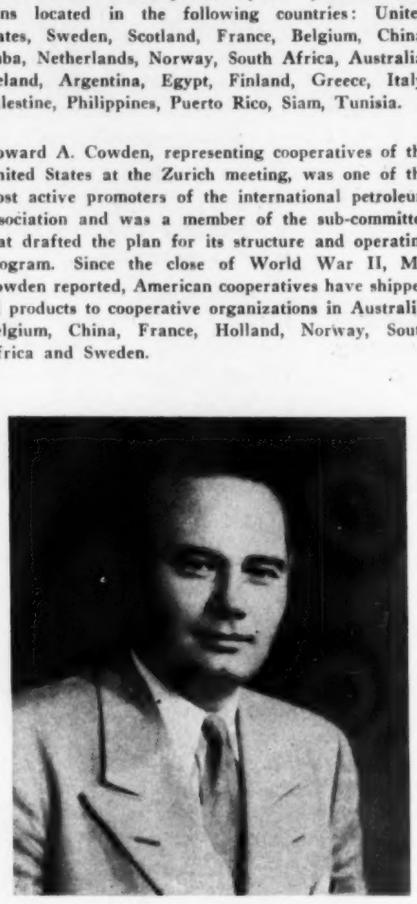
More massive building for war included more than 10,000 bomb cases for 2,000 to 4,000 pound block busters. The air war was aided by 22,000 Butterfield smoke generators, and over 90,000 self-actuating smoke floats. More than 18,000 containers for equipment to be dropped by parachute were made. For fighting petroleum fires more than 1,000 foam generating units were built. Untold thousands of Butterfield dust bins were used for food distribution, for popping over incendiary bombs and in industrial salvage work. Other Butterfield products included ammunition cases, food bins, decontaminating boilers, special vehicle bodies, platework for underground shelters and many others.

International Petroleum Cooperative

Formation of an international cooperative to develop trade in oil products among cooperative associations in different parts of the world was decided upon by representatives of the International Cooperative Trading Agency at a meeting held in Zurich, Switzerland, during the first week of October. The new organization is to have the name of International Cooperative Petroleum Association and is to be capitalized at $15,000,000 of which 60 percent has been pledged. It is to start operation as soon as ten central organizations sign the articles and subscribe $500,000.

According to a statement released by the news service of the cooperatives, willingness to participate in the movement has been expressed by twenty-two associations located in the following countries: United States, Sweden, Scotland, France, Belgium, China, Cuba, Netherlands, Norway, South Africa, Australia, Iceland, Argentina, Egypt, Finland, Greece, Italy, Palestine, Philippines, Puerto Rico, Siam, Tunisia.

Howard A. Cowden, representing cooperatives of the United States at the Zurich meeting, was one of the most active promoters of the international petroleum association and was a member of the sub-committee that drafted the plan for its structure and operating program. Since the close of World War II, Mr. Cowden reported, American cooperatives have shipped oil products to cooperative organizations in Australia, Belgium, China, France, Holland, Norway, South Africa and Sweden.



Robert D. Walker

Walker Joins Oilfield-Industrial Export

Robert D. Walker of Dallas, recently discharged as a Captain from the Air Force, has joined Oilfield-Industrial Export, Inc., at 30 Rockefeller Plaza, New York. Walker left New York on September 16 for an extensive trip through the oil fields of South America and the West Indies on behalf of his company after spending some time in the plants of this company's principals, Lee C. Moore & Company, Inc., and the Guiberson Corporation. Prior to joining the armed services Walker was active in the oil fields of the southwestern United States for ten years. Upon his return from South America Walker will be permanently located in New York.

Haifa Refinery Enlargement

Work will begin shortly on the enlargement of the refinery of Consolidated Refineries, Ltd. in Haifa Bay, Palestine, and will result in the production of high grades of lubricating oils and a fuller range of products than at present. The scale of the extensions will be of the size of the original construction which cost about 20 million dollars at pre-war prices. It will take two to three years to complete the additional plant, which is scheduled to be ready in time to receive the oil flow of the new 16" Iraq Petroleum Company's line now under construction from Kirkuk to Haifa.

The present Haifa refinery has a capacity of four million tons of crude oil a year, which equals the present crude flow through the IPC 12" lines to Tripoli and Haifa. The construction of the new 16" line will bring another four million tons of crude to Haifa annually, and this has been taken into account in laying the plans for the Refinery extensions.

The refinery is jointly owned by the Anglo Iranian Oil Company and the Anglo Saxon Petroleum Company (Shell), each of which have an interest in the Iraq Petroleum Company of 23¾ percent. Construction of the plant began at the end of 1938 and was completed in its present form two years ago. About 60 percent of the output is fuel oil and some 20 percent gasoline, while the remaining 20 percent include gas oil, kerosene, asphalt and butane. Among the new features to be added to the plant are a catalytic cracking unit and a lube oil unit.

Covering an area of 360 acres, the original refinery site will afford room for the additional units to be constructed, though extensive road and drainage works will have to be carried out, before anything new will be showing above the ground. A large part of the materials for the new plant will be supplied from England, while some specialized equipment has been ordered in the United States. Palestine industry will also have its share in the construction and will supply such items as cement and concrete pipes, apart from providing several thousands of laborers, engineers and foremen.

Some materials, including pipes, steel plates, iron girders, and valves are already arriving in Haifa Port and British and American construction experts are on the spot to get the work under way.

Foundry Experts Visit Hadfields Ltd.

Fifty leading foundry experts attending the British Steel Founders' Technical Convention held recently in Sheffield were received by Managing Director J. B. Thomas, at the East Hecla Works of Messrs. Hadfields Ltd., where they were able to study some of the important advances made in the technique of steel founding during the war years. Particular interest centered in the special high tensile steel castings produced for the "Tempest" and "Typhoon" and for other famous fighting aircraft and in the special methods of manufacture which were developed to ensure the soundness and consistent accuracy of these vital castings.

The latest developments in non-destructive methods of testing by X-rays, radium and supersonic technique were demonstrated and also the production of castings in manganese, austenitic, heat resisting, stainless and armour quality steels. Every method of melting from the Bessemer converter to the latest high frequency and arc electric processes can be seen in these foundries. Scientific sand treatment and recovery and core making methods were also subjects of keen enquiry and discussion.

Venezuelan Production

Production of crude oil in Venezuela during the month of August amounted to 33,792,246 barrels, an average of 1,090,072 barrels dailys. Exports for the month were 30,540,865 barrels. Production by companies is shown by the following table:

Company	*West*	*East*	*Total*
Creole	13,297,557	4,729,542	18,027,099
Mende Grande	1,682,865	3,948,380	5,631,245
Shell	8,459,899		8,459,899
Consolidada		782,627	782,627
Socony		768,719	768,719
Texas		75,095	75,095
B. C. O.	34,421		34,421
All Others	8,264	4,877	13,141
Totals (bbls)	23,483,006	10,309,240	33,792,246
Totals (M^3)	3,733,387	1,638,989	5,372,376
Exports (bbls)	21,784,858	8,756,007	30,540,865
Exports (M^3)	3,463,411	1,392,052	4,855,463

French Contract for Venezuelan Oil

Under an agreement which becomes effective January 1, 1947 Cie de Francaise des Petroles will purchase from Pantepec Oil Co. of Venezuela the crude accruing to the latter company from concessions which it holds in Venezuela. The contract is to run for three years and the oil is to be paid for on the basis of Gulf Coast prices for similar grades. The quantity to be delivered initially will be about 16,000 barrels daily but this will be increased as Pantepec's receipts expand under drilling agreements which are now in effect.

Cie Francaise also undertakes to share the cost of drilling 75 or more wells on Pantepec's holdings in the Mulata and El Roble fields which will call for an investment of perhaps $5,000,000. The French company also acquires an option on a half interest in other holdings of Pantepec in undeveloped areas.

Cie Francaise des Petroles, which is owned in part by the French government, is one of the constituents of the Iraq Petroleum Company and as such is entitled to approximately one-quarter of the oil produced by that company. This crude is used to feed its two refineries in France, one of which is located near Havre and the other at Martigues in the southern part of the country. The supply obtainable from Iraq, however, is not sufficient to meet the requirements of the two plants when operating at full capacity. Recourse to Venezuelan oil will assure the company of a dependable supply.

To Prepare German Reports

Dr. Warren F. Faragher of the Houdry Process Corporation has been selected by the Office of Technical Services, as the U. S. Government's representative to go to Germany to supervise the preparation by Germans of final reports on the German petroleum processes. Dr. Faragher left for Europe in October. Purpose of Dr. Faragher's mission will be to complete the collection of the German information on the programs surveyed by the U. S. Technical Oil Mission which was sent to Germany by the Petroleum Administration for War in 1945 and to have German reports prepared thereon.

Dr. Faragher was a member of this group which followed advance troop elements to investigate German manufacturing methods of hydrogenation, catalytic cracking, hydroforming, alkylation, polymerization, Fischer-Tropsch, and other processes. At that time, the chaos resulting from the war and the displacement of German technical personnel left unanswered many of the questions concerning German methods. In the past year, however, many of the missing technicians and numerous documents have been located and from them Dr. Faragher expects to obtain the data necessary for the completion of the reports.

German Fuel Secrets

Demonstrating to a considerable degree the remarkable progress of the Germans in producing synthetic liquid fuels, as well as many other synthetic products used in powering a gigantic war machine, the Bureau of Mines has released for distribution five technical reports dealing principally with wartime fuels and lubricants in Germany. The reports are part of a series describing investigations in Germany and other parts of Europe by the Technical Oil Mission. Titles of the Bureau publications released today follow:

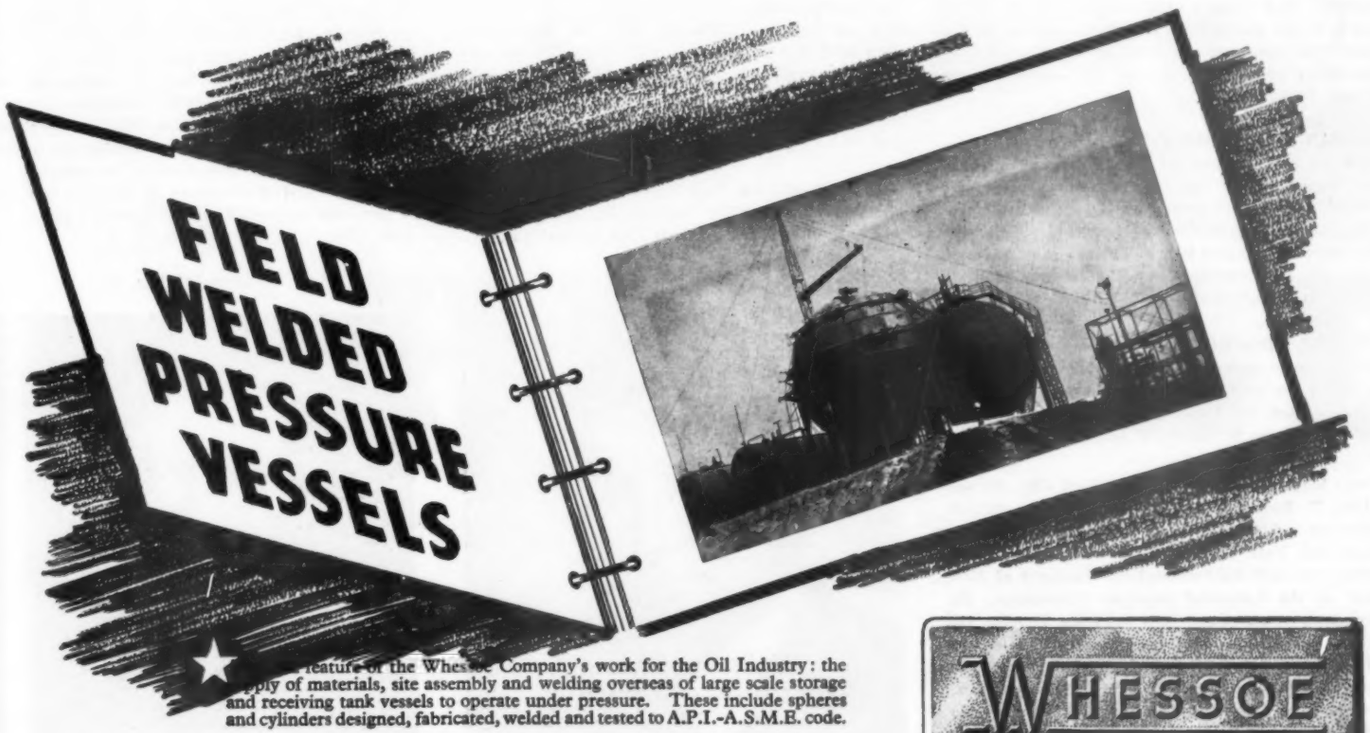
Information Circular 7368, "Manufacture and Regeneration of Catalysts at I. G. Farbenindustrie A. G. Plants, Ludwigshafen/Oppau, Germany," by W. F. Faragher and W. A. Horne.

Information Circular 7369, "Report on the Investigation by Fuels and Lubricants Teams at the Wintershall A. G., Lutzkendorf, near Mucheln, Germany," reported by H. Hollings of the British Ministry of Fuel and Power.

Information Circular 7370, "Report on the Investigation of Fuels and Lubricants Teams at the I. G. Farbenindustrie A. G. Leuna Works, Merseburg, Germany," edited by R. Holroyd of the British Ministry of Fuel and Power.

Information Circular 7375, "Report on Investigations by Fuels and Lubricants Teams at the I. G. Farbenindustrie, A. G., Works, Ludwigshafen and Oppau," edited by R. Holroyd of the British Ministry of Power. The Ludswigshafen factory was a general organic chemical works specializing in dyes, dye intermediates, plastics, and synthetic rubber and the Oppau plant was a heavy organic chemical factory producing ammonia, methanol, higher alcohols and their derivatives.

Information Circular 7376, "Interrogation of Dr. (Mathias) Pier and Staff, I. G. Farbenindustrie A. G.,Ludwigshafen and Oppau, Supplement II, Report on Investigations by the Fuels and Lubricants Teams," reported by W. F. Faragher and W. A. Horne. Single copies of the foregoing Information Circulars may be obtained by writing to the Bureau of Mines, Department of the Interior, Washington 25, D. C.



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WHESSOE

Oil Company Staff Changes

Comm. G. F. Kirshner

E. F. Phillips

COMMANDER G. F. KERSHNER, for the past four years with the U. S. Navy, has returned to Continental Oil Company, and has been made city manager at Chicago. He succeeds R. G. Kensel, who was recently promoted to be assistant manager, railway sales division, Chicago, according to Harry J. Kennedy, vice president. Commander Kershner was Continental city manager at Baltimore in 1942 when he was recalled to service. He was immediately assigned as gunnery officer to the aircraft carrier Sangamon, and participated in the invasions and occupations of North Africa at Casablanca, the Gilbert Islands at Tarawa, the Marshall Islands at Roi, Namur and Eniwetok, New Guinea at Hollandia, and the Marianas at Guam and Saipan. During his last six months aboard the Sangamon he also served as staff gunnery officer of Carrier Division 22, under Admiral Thomas Sprague.

HERMAN J. WORHRMANN has been named assistant purchasing agent for Shell Pipe Line Corporation, according to an announcement made by H. H. Anderson, vice president. He succeeds the late E. H. Lindesmith who died September 17. Shell Pipe Line's purchasing agent is J. B. Thompson, who served during the war emergency on the Houston staff of the Petroleum Administration for War.

WINTHROP ROCKEFELLER, recently discharged from the army with the rank of Lieutenant Colonel, has joined the staff of the producing department of Socony-Vacuum Oil Company, Inc., according to an announcement by B. Brewster Jennings, president.

He was born May 1, 1912 in New York City, the son of John D. Rockefeller Jr. and Abby Green Aldrich Rockefeller. After attending Lincoln and Loomis Schools and Yale University, Mr. Rockefeller's first position was with the Standard Oil Company of New Jersey in the industrial relations department. He subsequently spent three years with the Humble Oil and Refining Company, where he worked as an oil field hand in Texas. After studying finance with the Chase National Bank, he served in the foreign trade department of the Socony-Vacuum Oil Company in 1939. In January 1941 he enlisted in the Army as a private and a year later entered Officers' Candidate School.

E. F. PHILLIPS has been named manager of the newly-formed shallow draft marine department of the Standard Oil Company of New Jersey. Mr. Phillips entered the employ of the company in February 1935 as a member of the company's publications department staff, editing "The Esso Marketer" and "The Esso Dealer." In 1944 he was promoted to manager of the publications department, within the advertising-sales promotion department. G. O. Uhlmann succeeds Mr. Phillips in this position.

FRANK M. DAWSON, superintendent of the Lawrenceville, Illinois, refinery of The Texas Company, has been elected vice president in charge of operations of Carthage Hydrocol, Inc. Mr. Dawson has been with Texas for the past 18 years. At the same time the election of Allen K. Brehm, formerly of the Continental Bank and Trust Co. of New York, as treasurer was announced by G. G. Gabrielson, president of Carthage Hydrocol.

Ground already has been broken for the $15 million plant to be built near Brownsville, Texas, to synthesize gasoline and chemicals from natural gas.

Frank Dawson

C. L. LOCKHART. former operations manager of Shell Oil Company's Cleveland, Ohio, division, has been appointed manager of Shell's Sewaren, New Jsersey, plant, it was announced today by P. E. Lakin, vice-president, marketing. Lockhart succeeds H. V. LeBourveau who died recently. He began his career with Shell in 1929 as chief inspector of the St. Louis automotive department. In 1940, he was appointed operations manager, marketing operations, in the Cleveland office, which position he held until his present appointment.

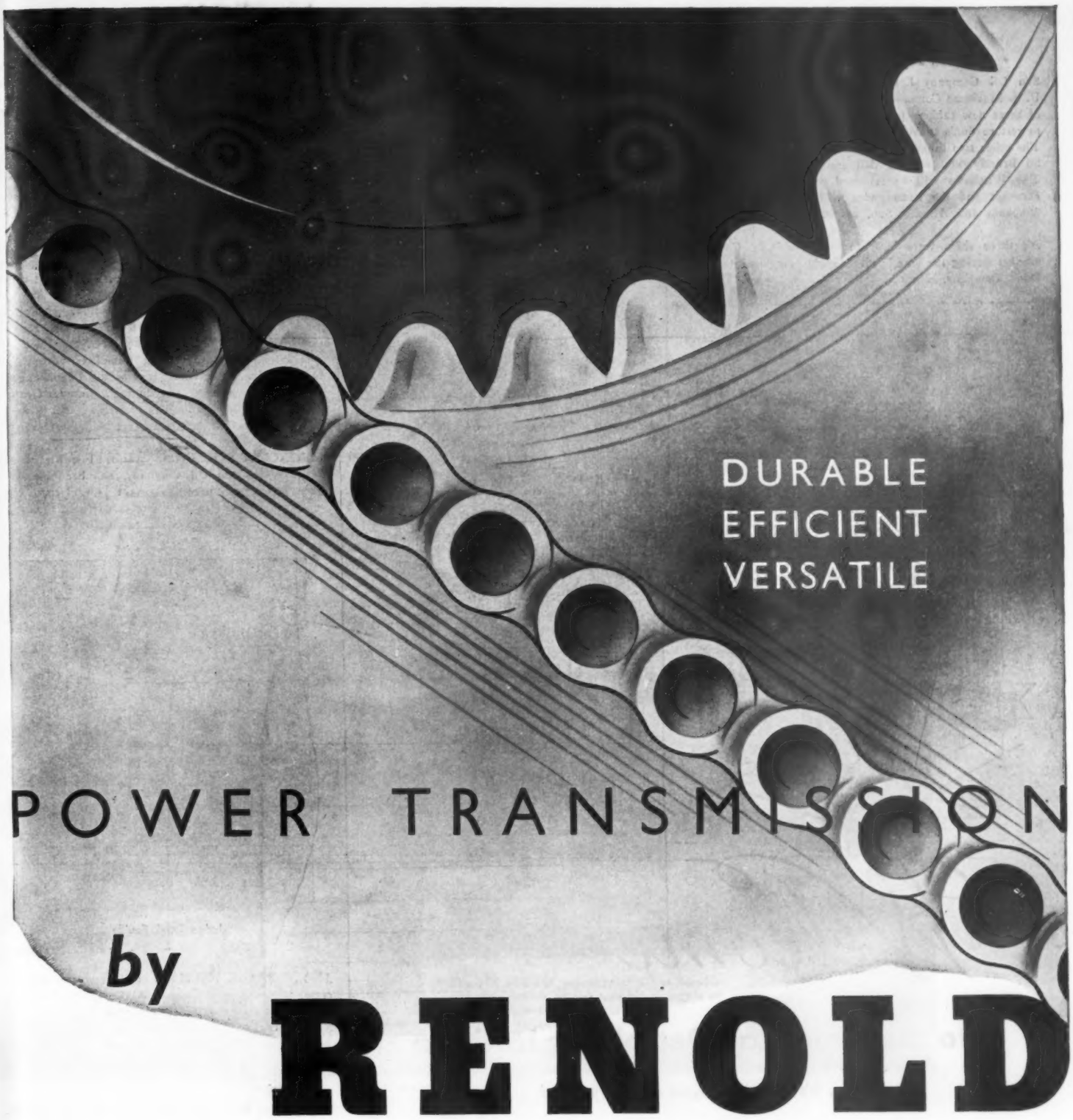
Lockhart is succeeded by J. S. Morse, who was operations manager in Shell's Detroit division prior to joining the Navy in 1942. Morse was released with the rank of Lieutenant Commander in February of this year. Since his return, Morse has been assistant to the plant automotive manager in New York in charge of a special package handling study.

R. L. GERAGHTY, until recently assistant manager of the auditing department, Shell Oil Co., Inc., New York, has been appointed manager of the marketing service department. In this capacity he will coordinate office work performed by Shell's head office marketing departments and division marketing service groups in the field. He started his career with Shell as a sales clerk in the Indianapolis marketing division in 1926. He became asisstant manager of the auditing department in the New York office in 1943.

WILLIAM EDWARD SMITH, 73, former president of the Standard Oil Company of Kentucky and veteran of 55 years in the oil industry, died October 2 at Louisville, Ky. In 1890 Mr. Smith entered the oil industry with his father, Harry Smith, one of the pioneer developers of the Franklin, Pa., oil fields. Later Mr. Smith was with the Standard Oil Company of New Jersey and the Standard Oil Company of New York. In 1921, he resigned from Socony to become vice president of the Standard Oil Company of Kentucky and in 1927 was elected president and director. He retained this position until ill health forced his resignation last year.

H. JANNEY NICHOLS, JR., general manager of the supply and transportation department, has been named a director of Standard Oil Company of New Jersey. Mr. Nichols was first employed in the development department in 1923. Transferring to the Technical Service Division in 1927, he later served as assistant manager in 1936, becoming general manager in 1937. Appointed head of the company's domestic coordination committee in 1938, he was named to head the supply and transportation department in June 1944.

H. Janney Nichols, Jr.



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Sun Buys Three Tankers

Sun Oil Company has accepted delivery from the U. S. Maritime Commission of the SS Waxhaws, first of three new tankers purchased from the government to restore Sun's tanker fleet to full pre-war strength. The other two tankers, the SS Point Pleasant and the SS Brandywine, will be delivered within a month. The Waxhaws will be renamed Sunoil. The Point Pleasant and the Brandywine will be renamed the Sunbeam and Atlantic Sun, respectively.

All three ships were built for the Maritime Commission during the war by Sun Shipbuilding and Dry Dock Company, Chester, Pa., a wholly-owned Sun Oil subsidiary. All were operated by Sun Oil for the War Shipping Administration and saw active war service. Acquisition of these ships, together with the MS Dynafuel, purchased several months ago, replaces all war shipping losses and brings the Sun tanker fleet to a total strength of 17 ships representing a total of 249,740 deadweight tons.

Transfers McIntire to New York

Russell V. McIntire has been transferred to the New York office of Baker Oil Tools, Inc., where he will assist in export sales of Baker products. McIntire was for thirteen years in the field department of Belridge Oil Company in California.

Welcome

to the American Petroleum Institute

. . . It's a privilege again to greet you and welcome you to Chicago. We hope your stay is enjoyable, and we offer our best wishes for a successful and constructive convention.

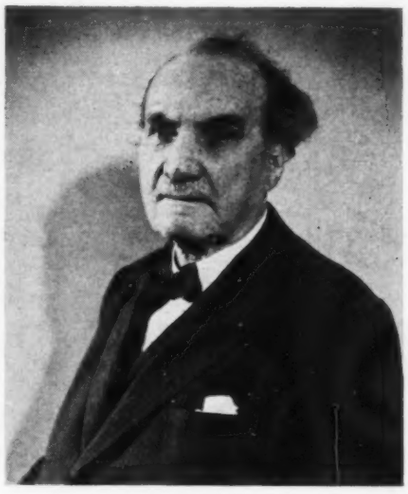
STANDARD OIL COMPANY (INDIANA)

C. H. LAMOREAUX, manager of the Wichita, Kan., sales field of Standard Oil Company (Indiana), has been promoted to assistant general manager of sales for the northern division with headquarters in Chicago. C. C. Smith, assistant manager at St. Louis, Mo., succeeded Mr. Lamoreaux, and F. M. LeValley, sales manager at Peoria, Ill., succeeded Mr. Smith.

Mr. Lamoreaux joined the company in 1924 as a salesman at St. Louis. Mr. Smith and Mr. LeValley joined Standard in 1923 as service station attendants.

WILLIAM H. MONTGOMERY has been appointed manager of the industrial relations department of the Socony-Vacuum Oil Company, Inc. He has been refinery manager of the company's Lubrite Division, East St. Louis, Ill., for the last three years. He succeeds W. H. Zabriskie, who has been appointed secretary of the manufacturing committee. From 1928 to 1941 Mr. Montgomery was at the Palembang refinery of the Standard-Vacuum Oil Company in the Dutch East Indies and was assistant general superintendent when he left there just before the war.

L. VINCENT COLLINGS, general counsel for Standard-Vacuum Oil Company, has been elected a director. He was named assistant general counsel for Standard-Vacuum in 1934 and General Counsel ten years later.



Judge Frank Feuille

JUDGE FRANK FEUILLE, vice-president and director of California Commercial Company, Inc., subsidiary of Standard Oil Company of California with headquarters in New York, retired after 26 years of service first with Standard and later with its subsidiaries. He served as an advisor on matters relating to Latin America.

Feuille was born September 10, 1860, in Havana, Cuba, and came to New York at the age of five. In June, 1902, he accepted a judicial office in Puerto Rico and two years later was appointed Puerto Rican attorney general by Theodore Roosevelt. In 1907 he went to Cuba to draft an outline of new laws for a democratic form of government. With only a few changes, his outline represents the laws of Cuba today.

C. HENRY HATHAWAY, 61, assistant to the president of the Gulf Oil Corporation, Pittsburgh, died at the Lawrence Hospital in Bronxville, N. Y. on October 7th after a short illness. Mr. Hathaway was associated with the Gulf Oil Corporation as assistant to the president from October, 1932 until his death. Previously, from 1929 to 1933, he was an assemblyman at Albany from Westchester County, New York.

The 100,000 bbl. refinery of Cities Service at Lake Charles, La.—a notable example of overall engineering.

However, this saving is not as immediately apparent as the reduction in the maintenance-parts inventory where *one* organization reduces the types and makes of pumps, valves, motors, etc., to a minimum. Customers can of course specify these items, but then responsibility for their performance must also be accepted.

4th and probably the most important consideration of all, is the fixing of responsibility on *one* organization. Where more than one organization is involved there is bound to be some place in the job where the customer "holds the bag" . . . a position that can affect the economics of a refinery operation adversely for a considerable period of time in case something does go wrong.

Thus, in the final analysis, just as "there is no substitute for the best design" to enjoy low manufacturing costs with concurrent high quality products—so "there is no substitute for overall engineering with undivided responsibility" to obtain maximum returns on every dollar expended for the expansion or modernization of refining facilities.

THE M. W. KELLOGG COMPANY

Engineers and Economists to the Petroleum Refining Industry

New York, N. Y. • Jersey City, N. J. • Los Angeles, Cal.
Tulsa, Okla. • Houston, Texas • London, Eng.

Parkersburg Buys Houston Company

The Parkersburg Rig and Reel Company has purchased properties of the Nowery J. Smith Company of Houston, Texas, with the exception of the commercial hot-dip galvanizing business which will be continued under the management of Tyson Smith. Nowery J. Smith will be a vice-president of The Parkersburg Rig and Reel Company and will continue in active charge of the Houston plant.

Ladish Opens Chicago Office

W. O. (Bill) Kupper has been made manager of middle western sales of the fittings division, Ladish Drop Forge Company. Offices have been opened at 332 South Michigan Avenue, Chicago. Mr. Kupper was formerly manager of southern sales for the fittings division.

Joins Oil Base Inc.

E. N. Steele has been appointed California coastal territory representative for Oil Base, Inc. Prior to joining Oil Base, Mr. Steele was head drilling engineer for Bell & Loffland drilling contractors, California division supt. for Baroid Sales Division, and manager of Antelope Materials Co. division, Macco Construction Co. Mr. Steele is well versed in drilling fluids, having had 11 year's experience in this field.

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86 years experience in marine construction has demonstrated our ability to provide the experience, equipment, and skill so essential to successful, on-time completion of marine terminals.

In the past three years alone, we have fulfilled the following contracts with the petroleum industry:

PROJECTS COMPLETED

Allied Oil Company, Inc.	Cleveland, Ohio
	Toledo, Ohio
Cities Service Oil Company	Linden, N. J.
Colonial Beacon Oil Company	Hartford, Conn.
	New London, Conn.
Gulf Oil Company	Brooklyn, N. Y.
	Devon, Conn.
The Pure Oil Company	Memphis, Tenn.
Royal Petroleum Company	Sewaren, N. J.
Shell Oil Company	E. Hartford, Conn.
	Fall River, Mass.
Socony Vacuum Oil Co., Inc.	Bridgeport, Conn.
	E. Providence, R. I.
	Hartford, Conn.
	New London, Conn.
	Norwich, Conn.
Standard Oil Company of N. J.	Bayway, N. J.
Sun Oil Company	Cleveland, Ohio
	Toledo, Ohio
Tide Water Associated Oil Co.	Bridgeport, Conn.
	New London, Conn.
	Scotch Cap, Conn.

PROJECTS UNDER CONSTRUCTION

Cities Service Oil Company	Braintree, Mass.
Socony Vacuum Oil Co., Inc.	Portsmouth, N. H.

MERRITT-CHAPMAN & SCOTT CORPORATION

ENGINEERING CONSTRUCTION DIVISION

17 BATTERY PLACE, NEW YORK

Sydney S. Smith

SYDNEY S. SMITH, manager of the products pipe line department of the Shell Oil Company, Inc., New York, was presented the Medal for Merit at a dinner at Tulsa on October 7. Col. C. H. Chorpening, Tulsa district engineer, represented President Truman in making the award, which is the civilian counterpart of the Distinguished Service Medal.

Mr. Smith conceived the idea for the portable line in 1939, when the German war machine started to roll through Europe. It was evident to him then that the conventional methods of transporting and storing the enormous quantities of gasoline that would be required to supply a mechanized army were impractical and machines and troops would be "bogged down" from lack of fuel. The usual type of pipe line was not practical for combat forces; it required too much time and labor to install, too elaborate pumping installations, and could not be moved quickly as the battlefield changed.

Following up his basic idea, he prepared a detailed engineering report in September, 1941, showing how to construct and operate the new line. By March 1942, he had set up a unit for demonstration to army officials at Shell's pipe line laboratory near Chicago. Later that month, a demonstration was given at Fort Belvoir, Va., and later tests were made at Camp Rapidan in the Shenandoah Mountains with four pump stations and 30 miles of pipe.

In the late fall of 1942, the operation at Camp Rapidan was transferred to Camp Claiborne, La., where the army trained engineering petroleum distribution detachments to operate the lines. The pipe line received its first real test in the invasion of North Africa, delivering oil from tankers offshore direct to the fighting forces.

Mr. Smith has been with the Shell Oil Company since 1924, when he became office manager of the company's natural gasoline division at Tulsa. He became manager of the division in the following year, and in 1935, was transferred to the company's manufacturing department in St. Louis. On January 1, 1938, he assumed his present position. He was a lieutenant in the Balloon Corps during World War I.

Heads Rheem Purchases

George J. Papas has been appointed general manager of purchases for the Rheem Manufacturing Company, it was announced today by W. E. Curran, vice president. He will make his headquarters in New York City and will direct purchasing for the company's eleven plants in the United States.

200 API Committees

(Continued from page 57)

James E. Moss, for years manager of marine operations for Atlantic Refining Company, was appointed director of the new transportation division this past year. Mr. Moss was drafted by the Coast Guard from Atlantic in 1942 as a consultant on tankers. He now will remain in Washington to coordinate all transportation activities of the Institute with committees on Automotive, Pipe, Rail and Water Transportation.

In the past 21 years the committee on accounting, working under 10 chairmen, has promoted uniform methods with remarkable success. When the committee first was organized in 1925 there were as many types of balance sheets and accounting methods as there were oil companies. Now most companies follow the same general plan of reporting. The "last in, first out" inventory system now adopted by most manufacturing companies of the nation is a development of the API committee. Present chairman is E. Chester Peet of Shell Oil Company.

The statistical advisory committee under A. J. McIntosh of Socony Vacuum Oil Co., has been one of the most active of the nine primary industry committees. The Institute now gathers weekly reports on crude oil production and refinery operations which are distributed to the industry and the public two months ahead of the official figures of the U. S. Bureau of Mines which now have become largely historical.

Reserves of crude oil are studied continuously by the committee under Dr. F. H. Lahee of Sun Oil Co., and annual reports are issued for the information and guidance of government authorities and the industry.

The pipeline study committee headed by T. E. Swigart of Shell Pipe Line Co., has been devoting its attention to protection of pipe lines from corrosion. Studies are made of effects of various soils on the lines and of the use of inhibitors and other means of retarding loss of metal.

A new feature of future meetings of the Institute will be the presentation of an award for distinguished service to the petroleum industry. Establishment of such an award was voted recently by the board of directors. John M. Lovejoy of Seaboard Oil Company, was named chairman of the committee of award. Recipient of the award need not be a member of the Institute or even directly of the oil industry. The award will consist of a gold medal.

"A Report to the People"

Under the above title the Stone & Webster Engineering Corporation has issued a 150-page book giving an account of how that Corporation participated in the design and construction of more than 40 major industrial plants that produced many kinds of fighting equipment for the use of the Allied forces during World War II—from 30-calibre ammunition to atomic bombs. In between these are included a number of plants for petroleum refining and manufacture of materials for rubber production. While not a technical treatise on any of these subjects, the book is of interest because it illustrates how American energy and initiative rose to the emergency of creating the arsenal of democracy that forged the weapon for crushing the Nazi menace. Some 200 photographs are used to show the interiors and exteriors of a varied assortment of munitions factories. Of interest is a large-scale and detailed map of the great Oak Ridge plant for producing uranium 235.

Publishes Autobiography

Dr. Vladimir N. Ipatieff, 79, Russian-born scientist who is professor emeritus of chemistry at Northwestern University, has just published his autobiography, "The Life of a Chemist" (Stanford University Press, $6.00). The chemist, director of the Ipatieff High Pressure and Catalytic laboratory in the Technological Institute at Northwestern, is noted for his training and encouragement of young American scientists, and for his researches which aided in the successful prosecution of the second world war. In addition to his work at Northwestern, he directs research for the Universal Oil Products Company.

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Gas Reserves of U. S.

Natural gas reserves of the United States are estimated at 148 trillion cubic feet according to a report submitted to the American Gas Association at its annual meeting held in Atlantic City during the second week in October. The compilation is the work of a special committee on reserves of which N. C. McGowen of United Gas Corporation is chairman and Lyon F. Terry of Chase National Bank is vice chairman. It is to be an annual feature of the Association's statistical activities.

A tabulation of proved reserves by states shows that more than half are located in Texas and that nearly 90 percent are in the following states:

State	Trillions of Cu. Ft.
Texas	78,306,676
Louisiana	19,849,393
Kansas	13,250,605
California	10,855,707
Oklahoma	10,079,938

The remaining 15.5 trillion feet are scattered among 19 states extending from Pennsylvania and New York in the east to Wyoming and Utah in the west.

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David F. Davis

DAVID F. DAVIS has been appointed manager of public relations for Standard-Vacuum Oil Company. His assignment will cover all of Standard-Vacuum's operating area which includes Australasia, China, Japan, the Malay Peninsula, Netherlands East Indies, the Philippines, and South and East Africa. The company has oil producing and refining facilities in Sumatra and markets throughout most of the eastern hemisphere.

Mr. Davis joined the Jersey Standard organization in 1929, later becoming head of sales promotion activities for Esso Marketers. He was assigned to the parent company's public relations group at Rockefeller Center in 1943, where he has been in charge of liaison with Jersey's foreign and domestic affiliates.

S. A. Newman

S. A. NEWMAN, turbine lubrication specialist recently released from service as a Captain in the Navy, has been appointed chief turbine lubrication engineer by Gulf Oil Corporation. He will direct lubrication engineering activities in connection with all forms of turbines in the 30 states comprising Gulf's marketing area. He was assigned to Guam by the Navy shortly before the outbreak of war. During the Jap attack he assisted in destroying a million and a half dollars of engineering equipment, and was one of the last men captured on the island. He was a leader in maintaining morale in the several Jap prison camps in which he was held during the remainder of the war; and later at the request of Gen. MacArthur assisted in preparing the trials against Jap perpetrators of prison camp atrocities.

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Transamerican Organized to Serve Oil and Equipment Industries

In recognition of the growing importance of export business to American equipment manufacturers and particularly of exports to Latin America, Victor E. Milch and associates have organized Transamerican Factors Ltd. with headquarters at Los Angeles. Aim of the new organization is to offer service to both the manufacturer in North America and the user of equipment in South America. A slogan "Better service through better understanding" has been adopted.

Victor E. Milch

Transamerican now has branches in Colombia, Venezuela, Ecuador and Peru to serve the Latin American oil industry according to an announcement by Mr. Milch, resident American partner. Other guiding heads of the organization are Dr. Gonzalo Acosta Sarmiento and Dr. Hernando Madero Paris.

Branches of the company in South America are staffed entirely by Latin Americans but in every instance the representatives have been especially trained in the United States so that they are completely familiar with specialized oil country equipment manufactured in North America. Each man is a graduate petroleum engineer with years of experience.

Transamerican now represents seven California manufacturers of oil field equipment and supplies. They include Pacific Valve and Pump Co., Long Beach, manufacturer of cast steel valves; Oil Base, Inc., Los Angeles, manufacturers of Black Magic drilling mud; Superior Tank and Construction Company, Los Angeles, manufacturers of oil and gas separators and bolted steel tanks; Joshua Hendy Iron Works, Sunnyvale, manufacturer of stationary and marine Diesel engines, Crocker-Wheeler generators and T & C pneumatic pumps; Willis Oil Tool Company, manufacturer of adjustable flow beans and H. P. gaskets; Wilson Oil Tools Corporation, Ltd., Ventura, manufacturers of landing bases, packing and tubing heads, flanges, special fittings and connections; and Page Oil Tools, Inc., tubing anchor catchers, multiple zone packers, safety blowout plugs, tubing coupling drains.

Dr. Gonzálo Acosta Sarmiento

Dr. Hernando Madero Paris

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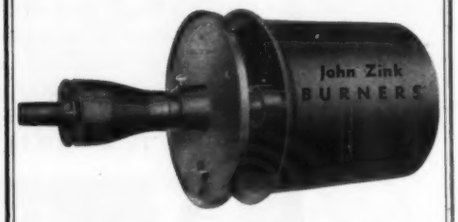

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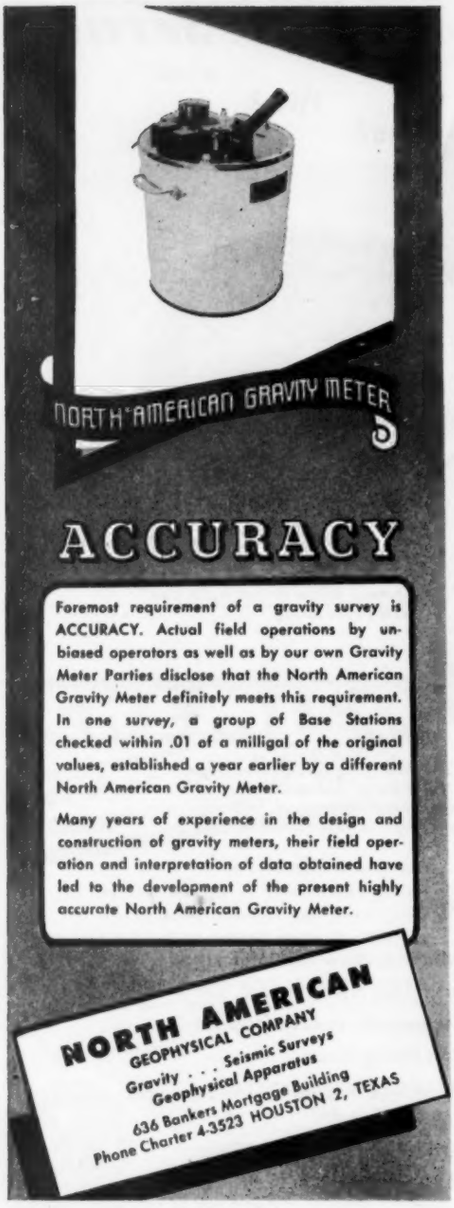
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Paulsboro 30 Years Old

Old-timers, who witnessed the firing of the first crude still in 1916, were honor guests recently as the Paulsboro refinery of the Socony-Vacuum Oil Company, Inc., celebrated its 30th anniversary. At an informal luncheon Manager Howard W. Sheldon welcomed the guests and L. W. Van Leuven, first refinery manager, responded. Among the honor guests were 42 employees who have been employed by the company for more than 30 years.

From an original 14 buildings, a staff of 300, with a monthly payroll of $57,000, the refinery has grown to a plant, consisting of 243 buildings, a staff of 2,377 and a payroll of more than $625,000 per month.

Hydrocarbon Analysis Manual

The Natural Gasoline Association of America has published a 12-page manual titled "N.G.A.A. Recommended Procedure for Analysis of Saturated Hydrocarbon Gases by Low Temperature Fractional Distillation." The manual is N.G.A.A. publication No. 1146 and may be obtained from the association's Tulsa Offices in the Kennedy Building at 50 cents per copy. Procedures covered by the pamphlet were adopted by the association at its twenty-fifth annual meeting at Dallas last April.

Oscar Lasse

OSCAR LASSE has been appointed manager of the personnel department of The Texas Company, succeeding the late Charles O. Strahley, it was announced today. He has been with the company for the past 30 years, and has been associated with Texaco's personnel department since 1929. Mr. Lasse was employed by The Texas Company in August, 1916, as a stenographer. In 1939 he was placed in charge of personnel research, and in 1942, was appointed assistant to the manager of the personnel department.

Orders Pipeline Engines

Plans for the construction of the largest diameter oil pipeline in the world, to be built by the Creole Petroleum Corporation between La Salina, Maracaibo and Paraguana Peninsula, in Venezuela, have been revealed with the placing of an order with The Cooper-Bessemer Corporation, for 16 of its Type LS-8-cylinder gas-Diesel and Diesel engines. The pipeline is to be used primarily for transporting crude oil to the company's refinery at Amuay Bay, a distance of approximately 150 miles. From the refinery, oil will be pumped directly to oil tanker loading docks in the same vicinity.

Twelve Cooper-Bessemer gas-Diesel engines are to be used to furnish power for two pumping stations located at Ule and Dabajura. These will drive Worthington Tri-Plex pumps and each will be rated 1,000 horsepower at 300 revolutions per minute. The other four units, supercharged LS Diesels, will be located in the Amuay Bay power station to drive generators for loading pumps, discharging oil into ocean-going tankers at the docks and for general electrical power. These will operate at a speed of 327 revolutions per minute, producing 1575 horsepower each.

Prof. Uren's New Book

"Petroleum Production Engineering: Oil Field Development" by Lester Charles Uren, professor of petroleum engineering in the University of California, has now appeared in a third revised edition to comprise the advances made in this art since 1934. The revision was made necessary by the fact that wells are now being drilled to great depths, new and more efficient types of drilling equipment have been developed, new methods of casing have been devised, new techniques of logging, testing and completing oil wells have been perfected, and the principles governing oil-field development have become better defined.

How extensive and varied is the knowledge required of the modern petroleum engineer will be impressed upon every reader who examines this text book of 764 pages. Prof. Uren arranges and handles his material with the skill and insight he has shown in previous editions; the orderly sequence of topics and the clear style smooth the way of the student, and adapt the book as a reference manual for oil company executives and others who lack specialized training.

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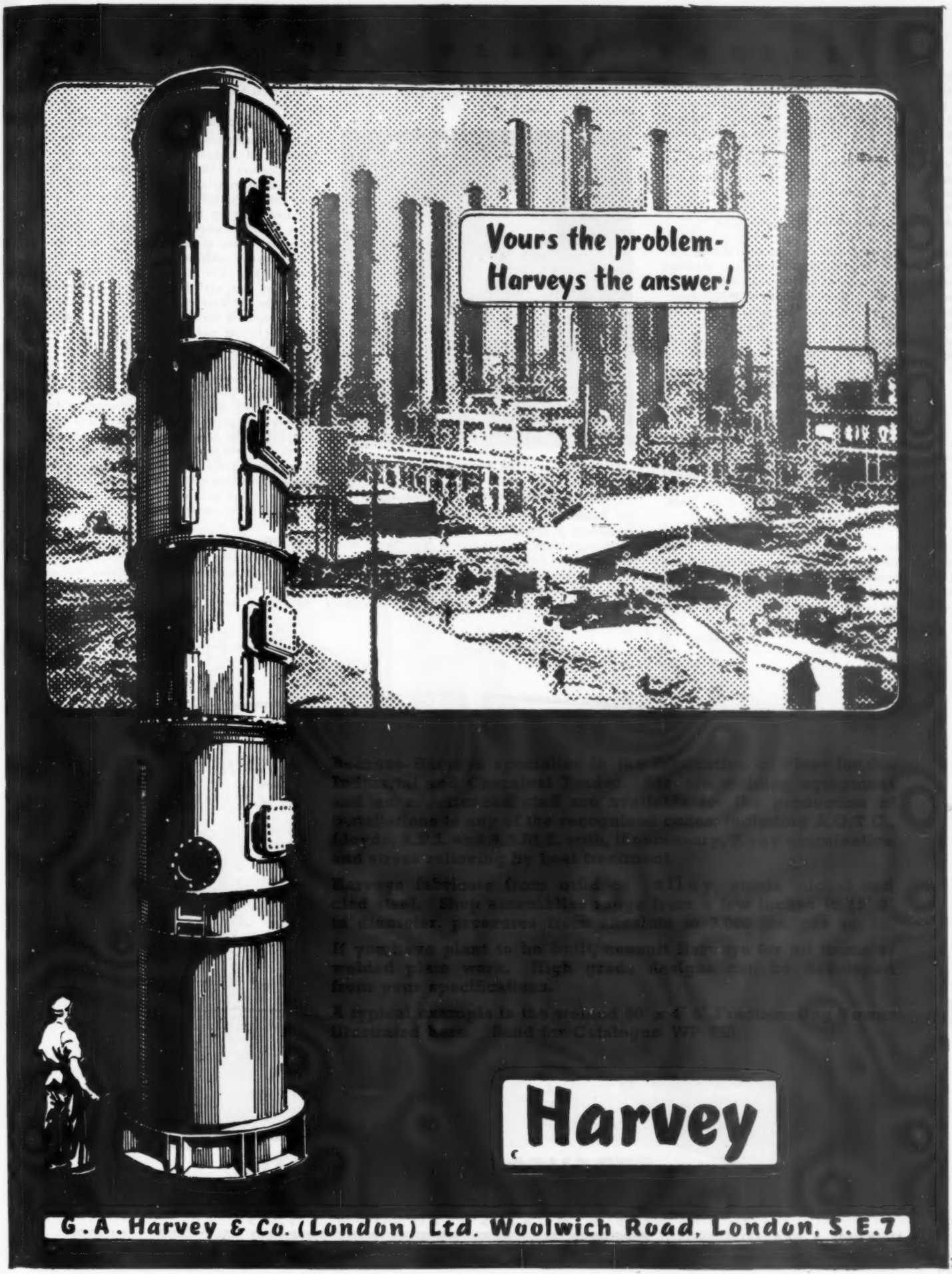
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Atlantic Buys Two Tankers

The Atlantic Refining Company has bought two large, high-speed tankers, from the Maritime Commission at a cost of $4,000,000. The SS Fort Caspar, one of the tankers, will be renamed the SS Atlantic Exporter, the other, the SS Honey Hill, will be operated under the name SS Atlantic Dealer. They were built last year at the yards of the Sun Shipbuilding and Dry Dock Company, Chester, Pa. These tankers are 16,600-ton deadweight, all-welded, turbo-electric drive vessels, with a speed of 14.5 knots and a carrying capacity of 141,000 barrels of gasoline each.

Atlantic now owns and operates four similar type vessels which were purchased from the Maritime Commission last year. The company's fleet also includes five larger tankers—deadweight, 19,2000 tons—which were built at the Sun shipyard. With the acquisition of the two new vessels, the company now has a total of 16 tankers. Fourteen of these vessels are operated under the American flag, and two carry the flag of Panama. The total deadweight tonnage of the fleet is approximately 250,000 tons.

Heat Loss Control Booklet

In a new 20-page manual for process engineers and power men, "Control of Industrial Heat and Power Losses," the Industrial Mineral Wool Institute gives nine case-histories of fuel cost savings resulting from proper insulation of piping, flanges, drum-heads, driers, boilers, and other hot surfaces.

Typical applications are described in detail, with simple formulae for determining heat-losses, and tables of necessary data for using the formulae. This material is supplemented with a "Heat Loss Estimate Sheet" for the reader's use in calculating heat losses from his own equipment. Descriptions and pictures of the various forms of mineral wool and other useful information are included. Copies may be obtained from the Industrial Mineral Wool Institute, 441 Lexington Avenue, New York 17, N. Y.

Frank Bergeron

Frank Bergeron Made Export Manager

The Baasch-Ross Tool Company has announced the appointment of Frank E. Bergeron as manager of its export department headquarters in New York. Mr. Bergeron spent a number of years as a mining engineer and geologist before joining the Baasch-Ross organization some eleven years ago. He advanced through various manufacturing and sales posts to the position of sales manager. It is from that position that he has been moved to his new duties as Export Manager. Baasch-Ross export offices now are located at 11 West 42nd Street, New York.

Sponsors Experimental Farm

A new experimental farm to be operated by the department of agricultural engineering of the college of agriculture of Ohio State University and the Ohio agricultural experiment station at Wooster will be established near Columbus, Ohio, as a result of plans released today by H. F. Sinclair, president of Sinclair Refining Company. The project is designed to help solve many of the problems of agriculture and mechanization confronting the farmers of Ohio and the corn belt. The program will include a study of the effect that variations in depth and spacing of drain tile will have on water in the soil and on soil temperatures in the spring; a study of timeliness in tillage, planting and harvesting operations, and the yield and quality of various crops.

A study of power and labor requirements in crop production is also planned. This area of study will have a special application to the efficiency of a tractor in which the economical use of fuels and lubricants is an important factor. The topography and size of the farm is well suited for research in land drainage, power, and mechanical efficiency. Sinclair Refining Company has been quite active in the farm field. This farm is further evidence of the close-knit association of industry and agriculture.

EUGENE J. HOUDRY, inventor of the Houdry catalytic cracking process, will head the delegation which the Houdry Process Corporation will send to the first South American Petroleum Institute which will meet in Lima, Peru, in March, 1947.

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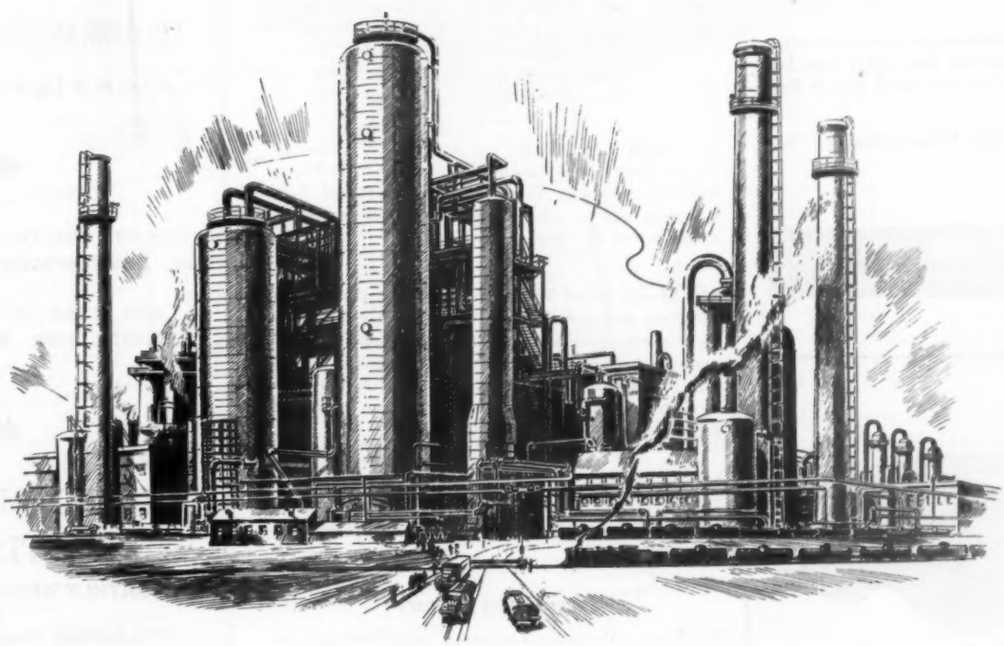
Q. **Which company operates the largest combination crude distillation and Houdry catalytic cracking unit in the United States?**



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William Naden

WILLIAM NADEN has been named a director of the Standard Oil Company of New Jersey. He is manager of the company's employee relations department. Mr. Naden joined the Colonial Beacon Oil Company in 1927 as a chemist in its Everett Refinery and was appointed superintendent of the refinery in 1934. He later became general superintendent of the Jersey Company's refinery at Baltimore. During the war he was in charge of refining for PAW District No. 1. In July 1944 he was made head of the Employee Relations Department.

WILLIAM J. MORRIS has retired as active executive head of the Continental Supply Co. at Dallas after 40 years with The Youngstown Sheet and Tube Company and its sales subsidiary. He was succeeded by Frederick M. Mayer, president.

Mr. Morris joined The Youngstown Sheet and Tube Company as a cost clerk in 1906. Within a few years he was vice president in charge of finances and the early 1930s went to Dallas to head Continental. He will continue as chairman of the board and will be available when needed in an advisory or consulting capacity.

Mr. Mayer has been president of Continental since July, 1945. He joined the company as treasurer in 1932 and was elected a vice president the following year.

Enlarge Tulsa Refinery

The Texas Company announced recently plans for the modernization and expansion of its West Tulsa Refinery, Tulsa, Oklahoma. Plans call for the construction of a new crude pipe still of approximately 30,000 barrels per day capacity to replace the present shell stilling equipment. In addition, the company plans to construct fluid catalytic cracking and recovery equipment consistent with the plant's crude throughput, a catalytic polymerization unit, an acid treating and sweetening plant, additional steam generating and distributing equipment, cooling water facilities, and other auxiliary construction.

Heat Treatment Booklet

A simple, straight-forward discussion of the fundamentals of heat treatment has been prepared by the Research and Technology Department, Carnegie-Illinois Steel Corporation, United States Steel Corporation Subsidiary. This 2-color, 54-page booklet, entitled "Suiting the Heat Treatment to the Job" is illustrated with charts, diagrams and photographs.

The book deals principally with the factors concerning hardness, covering heating, pearlite, bainite, martensite, S-curve, hardenability, and quenching; and with toughness, covering such factors as tempering, shape of piece, notch-bar, austempering, stresses and cracking. Six concise fundamental statements summarize the detailed explanations, and a valuable table of Jominy and quench distances vs. bar diameters for six different quenching conditions concludes this new booklet.

GUY L. TATE has been elected a vice president in charge of marketing and a director of Magnolia Petroleum Company. He succeeds George Miller who was forced to resign after 34 years with the company because of ill health. Mr. Tate has been with Magnolia for 31 years in various capacities from clerk to assistant treasurer and secretary.

W. B. Rew was named manager of marketing at the same time. He has been assistant marketing manager.

COLOMBIAN OIL NEWS DIGEST
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Source	Gravity API	Water %	Chlorides ptb. * as NaCl	Sulfates ptb. * as Na_2SO_4	Calcium & Magnesium ptb. * as NaCl
Texas, Duggan-Slaughter	31.8	0.05	191	8.3	151
Texas, Ector County	34.5	0.1	104	12.0	28.4
California, Dominguez	29.5	1.5	151	Trace	18.7
California, Santa Maria	15.5	0.7	110	1.0	19.3
Oklahoma, Wilcox Sand	41.3	0.2	81	4.2	19.2
Michigan, West Branch	32.3	0.1	141	10.8	45.5
Canada, Vermillion	15.2	1.0	305	Trace	84
U.S.S.R., Buguruslan	28.5	1.1	300	2.0	41
Egypt, Ras Gharib	18.4	2.4	1,085	4.0	165
Argentine, Cachueta	29.8	2.0	525	—	—

*ptb. = pounds per 1000 bbls.

It doesn't seem likely that such a small percentage of B. S. & M. in charging crude could cause trouble—but very small quantities of water often carry dangerous quantities of salts. Petreco research chemists have made extensive salt analyses of crude oils from all over the world. The table shows how low cutting crudes often carry high salt contents. (For more complete information, write for the *Petreco Manual on SALTS IN PETROLEUM.*)

In many refineries Petreco Electrical Desalting is the accepted standard process for salt removal. If your refinery is having trouble with plugging, corrosion, scaling or excessive down-time—have a talk with a Petreco Desalting Engineer.

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5121 So. Wayside Drive, Houston 1, Texas
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Representatives in principal producing and refining centers.

PETRECO

DESALTING ★ *ELECTRICAL PROCESS* ★ DEHYDRATING

George A. Hays

Hays Heads Hinderliter

George A. Hays has been appointed vice president and general manager of the Hinderliter Tool Company, a Division of H. K. Porter Company, Inc., at Tulsa, following the retirement of Frank J. Hinderliter who founded the company in 1920, it was announced, by Mr. T. M. Evans, president. Hinderliter Company manufactures oil field drilling equipment. Mr. Hays was formerly vice president of Oil Well Supply Company. He had been associated with that company and its affiliates in various capacities since 1922.

WILLIAM A. BAKER has joined Shell Pipe Line Corporation as vice president and treasurer, it was announced by T. E. Swigart, president. Baker has been with the Shell Oil Company for 25 years. He has been assistant treasurer at Houston for the past six years.

Elmer J. Weis

Pacific Pumps Elects Weis

Elmer J. Weis has been elected president and director of Pacific Pumps, Inc. At the same time, he was appointed general sales manager. Mr. Weis has been with Pacific Pumps since its establishment by his brother, Arthur R. Weis, now president, and himself in 1923. He is well known throughout the oil industry, having supervised many large installations of centrifugal pumps both in America, and abroad. Mr. Weis' activities at Pacific Pumps during the war contributed greatly to the citations received by the company from the War Department, the Maritime Commission, and the War Production Board.

Moves Desalting Headquarters

The Tretolite Company has moved its desalting department headquarters from Houston to St. Louis. Services available to the industry in desalting, demulsifying and affiliated activities will be broadened. In recent years Tretolite service has been expanded to include consultation, research and commercial applications of water clarification chemicals, pour point depressants, surface tension depressants, inhibitors for use in acid treatments and demulsifiers and foam preventers for use in doctor treating and other sweetening solutions.

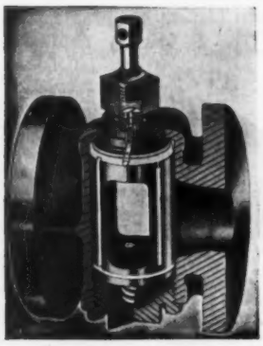
Drilling in Maryland

Continuing its search for oil along the Atlantic Coast, Standard Oil Company of New Jersey is drilling its first exploratory well in Maryland on a site three miles north of Ocean City. Standard has 80,000 acres of leases on state properties in the area of Sinepuxent, Chincoteague and Assawoman Bays.

This will be the company's second exploratory well operation on the Atlantic. The first, at Cape Hatteras, was dry at 10,054 feet.

NEWMAN-MILLIKEN VALVES
FOR REFINERY SERVICES

Newman-Milliken lubricated plug valves are used on the severest refinery services. They never leak or jam and will solve your corrosion and abrasion problems. A Newman-Milliken Valve is one of the simplest made having only eight parts including a cylindrical plug, consequently all parts are interchangeable and there is no gland packing or gaskets to renew from time to time causing a breakdown of the line. You can fit these valves and be sure of trouble-free service well beyond the life of the ordinary type of valve.



★ This sectioned illustration of a flanged Newman - Milliken Valve shows the cylindrical plug and lubricant ducts which seal the valve against leakage and ensure easy operation at all times. A rectangular port valve is shown, but full round port valves are also manufactured.

NEWMAN-MILLIKEN
Glandless Lubricated Plug Valves
IN SUITABLE TYPES TO MEET EVERY OIL SERVICE REQUIREMENT

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